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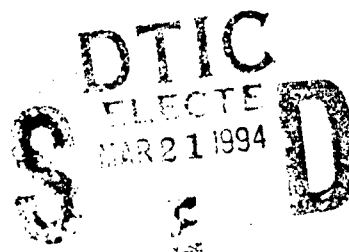
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Rocky Mountain Arsenal

Proposed Final
Remedial Investigation Report
Volume VII
Eastern Study Area, Section 2.0
Version 3.2

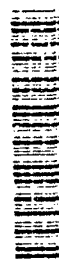
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PREPARED FOR:

U.S. ARMY PROGRAM MANAGER'S OFFICE
FOR ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP

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- Plate ESA 1.5-4 Alluvial Aquifer Saturated Thickness (April to June 1987) in the Eastern Study Area
- Plate ESA 2.0-1 Soil Boring and Well Location Map

Standard Abbreviations used in Eastern Study Area Report

1. Analyte Groups

VHO	Volatile halogenated organic compounds
VHC	Volatile hydrocarbons
VAO	Volatile aromatic organic compounds
OSCM	Organosulfur compounds, mustard-agent related
OSCH	Organosulfur compounds, herbicide related
OPHGB	Organophosphorous compounds, GB-agent related
OPHP	Organophosphorous compounds, pesticide related
DBCP	Dibromochloropropane
ONC	Organonitrogen compounds
PAH	Polynuclear aromatic hydrocarbons
SHO	Semivolatile halogenated organic compounds
OCP	Organochlorine pesticides
ICP Metals	Metals analyzed for by inductively coupled argon plasma, includes cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), and zinc (Zn)
As	Arsenic
Hg	Mercury
2. National Acts & Organizations

AMCCOM	Armament, Munitions, and Chemical Command
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
NCP	National Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
SARA	Superfund Amendments and Reauthorization Act
USACOE	United States Army Corps of Engineers
USAEWES	United States Army Engineer Waterways Experiment Station
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USAEWES	United States Army Engineer Waterways Experiment Station
USDA-SCS	United States Department of Agriculture - Soil Conservation Service
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
3. Local Terminology

BCF	Bioconcentration Factor
BCRL	Below Certified Reporting Limit
CAR	Contamination Assessment Report
CDH	Colorado Department of Health
CDOW	Colorado Division of Wildlife
CRL	Certified Reporting Limit
CSA	Central Study Area
EA	Endangerment Assessment
ESA	Eastern Study Area
ESP	Electrostatic Precipitator

FS	Feasibility Study
NCSA	North Central Study Area
NBCS	North Boundary Containment System
STP	Sewage Treatment Plant
PMO or PMRMA	Program Managers Office for the RMA Contamination Cleanup
RAA	Remedial Action Alternative
RI	Remedial Investigation
RIC	Resource Information Center
RMA	Rocky Mountain Arsenal
RMACCPMT	Rocky Mountain Arsenal Contamination Cleanup Program Managers Team
SAR	Study Area Report
SCS	Soil Conservation Service
TPP	Technical Program Plan

4. Companies

EBASCO	Ebasco Services Incorporated
ESE	Hunter/Environmental Science & Engineering, Inc.
G&M	Geraghty & Miller, Inc.
HLA	Harding, Lawson, & Associates
MKE	Morrison-Knudsen Engineers, Inc.

5. Unified Soil Classification System (USCS) Textural Key

CL	inorganic clay, low plasticity
CH	inorganic clay, high plasticity
GC	clayey gravel
GP	poorly graded gravel
MH	inorganic silt
ML	inorganic silt, low plasticity
SC	clayey sand
SM	silty sand
SP	poorly graded sand
SW	well graded sand

6. Measurements

ac-ft/yr	acre - feet per year
cfs	cubic feet per second
msl	mean sea level
ppm	parts per million
ppb	parts per billion
µg/g	micrograms per gram, equivalent to parts per million (ppm)
µg/l	micrograms per liter, nearly equivalent to parts per billion (ppb)
AA	atomic absorption
Co	ratio of contaminant concentration in an organism
CVAA	cold vapor atomic absorption
Eh	oxidation potential
f _{oc}	soil organic carbon content

GC/EC	gas chromatography/electron capture
GC/MS	gas chromatography/mass spectrometry
K_d	soil - water coefficient
K_h	Henry's Law constant
K_{oc}	organic carbon partition coefficient
K_{ow}	octanol - water partition coefficient

2.0 CONTAMINANT DISTRIBUTION

This section discusses analytical methodologies and presents the results of chemical analyses performed on soils, surface water, groundwater, structures, air, and biota samples collected from the ESA. The results from visual inspections of structures for potential contaminants is also presented in this section. Each of the five media, soil, water, air, structures, and biota, are discussed separately. For previously designated sites and nonsource areas studied during the RI program, much of the soils analytical data was presented on a site-by-site basis in the Phase I CARs. Results of Phase II investigations are presented in Phase II data addenda packets for the respective sites and nonsource areas. The CARs used for the compilation of this report were listed in Section 1.0 on Table ESA 1.1-1.

Overall, 634 Phase I soil borings were drilled in the ESA, and 1,135 samples were analyzed for the Phase I suite of analytes. A total of 195 Phase I soil samples were also analyzed for chemical agent degradation products. A total of 117 Phase II borings were drilled, and 322 samples were analyzed for various analytes to further investigate potentially contaminated areas and to evaluate previously unidentified areas. The locations of all borings, as well as all water quality monitoring wells, are presented in Plate ESA 2.0-1. Phase I geophysical surveys were conducted at all sites suspected of metal disposal or burial, and trenching activities were conducted at seven sites to further investigate areas of anomalous geophysical response. Eighteen Phase I programs were conducted at sites in the ESA, and all or portions of twelve nonsource area investigations were within the ESA boundaries. Phase II programs were conducted at 13 sites and in six nonsource areas. Biota and air samples were collected from the ESA and structures were surveyed. Additional information, as ascertained from previous investigations, is discussed in Section 1.1.1, involving the collection and analysis of geologic, hydrologic, and geochemical data from wells and borings in the ESA.

Surface water sampling was conducted at seven locations along First Creek, and stream elevation measurements were taken from two stations. Groundwater samples were analyzed from as many as forty wells per fiscal year quarter in the ESA, and water levels

were obtained from as many as sixty-three wells per fiscal year quarter. Analytical suites for water samples were based on the Tasks 4, 25, and 44 programs, and are discussed in detail in Section 2.2. The water analytical data used in this report were taken from the Water RI Draft Final Report (Ebasco, 1989/RIC 89067R08); the Final Initial Screening Program Report (ESE, 1987b/RIC 87253R01); the Final Screening Program, Third and Fourth Quarters, Final Report (ESE, 1988k/RIC 88173R06); and the Boundary Control Systems Assessment Draft Final Report (ESE, 1988dd/RIC 89024R02).

The potential for contaminants in structures was classified based on historical data and visual inspections; the results are discussed in Section 2.4. Data for this section were taken from the Structures Survey Final Summary of Results Report (Ebasco, 1988w/RIC 88306R02). Air quality in the ESA was monitored for total suspended particulates in one location and is presented in Section 2.5. Data for this section were taken from the Air RI Final Report (ESE, 1988s/RIC 88263R01). Biota samples from several plant and wildlife species were analyzed, and the results are summarized in Section 2.6. Data for this section were taken from the Biota RI Draft Final Report (ESE, 1989a/RIC 89054R01).

Many of the figures in this section present the distribution of contaminants in the different media. Boring, well, surface water, and biota sampling locations on these figures were plotted by computer onto a grid system defined by State Planar Coordinates. These locations were then projected onto a study area base map generated from Basic Information Maps, which were originally developed by the Army Corps of Engineers.

2.1 SOIL AND SEDIMENT SAMPLES

Soil and sediment samples were collected from each of the six site groups within the ESA. A total of 751 borings, yielding 320 composite and 1,137 uncomposited soil and sediment samples, were completed in the ESA during the course of the Phase I and II RIs under Tasks 7, 14, 15, 20, 21, and 22. Composite soil samples were obtained from nonsource areas, and consisted of soil taken from the 0 to 1 and 4 to 5 ft intervals. Uncomposited soil samples were obtained from sites suspected to contain contaminants.

In several instances, auger refusal did not allow the planned depths to be obtained. The objective of Phase I was twofold, to screen for areas of significant contamination, and to collect samples in areas where no historical or physical evidence of activity existed. The second objective provided background analytical information on large areas. The objective of Phase II was to further investigate any specific areas containing contaminants that were identified during Phase I and to better define the horizontal and vertical extent of contaminants.

2.1.1 Sampling Program and Analytical Methods

The soils investigation at RMA was conducted in two phases. Phase I investigations identified potential contaminants and provided a preliminary assessment of the vertical and lateral extent of contaminants. Phase I results also provided the basis for the design of a more quantitative Phase II program. Phase II sampling was conducted at some sites to provide a more quantitative assessment of the vertical and areal extent of detected contaminants. Data from Phase I of the RI were published in the CAR for each site and nonsource area, and Phase II data were published in a corresponding Phase II Data Addendum. These documents are listed and referenced in Section 1.1 of this report.

In the Phase I program, soil borings were drilled to various depths in the vadose zone. Samples were generally collected from these borings at standard sampling depths of 0 to 1, 4 to 5, 9 to 10, 14 to 15, 19 to 20 ft, and at 10 ft intervals below 20 ft. Samples were collected from nonstandard intervals where drilling was difficult or where staining or other evidence of potential contamination was observed in the core. Phase II samples were collected either at standard intervals or in depth intervals above and below Phase I samples in which contaminants were detected.

Samples from the Phase I borings were analyzed for a standard suite of compounds. The Phase I analyses for target compounds are listed in Appendix A and include:

- o gas chromatography/mass spectrometry (GC/MS) analysis for volatile organics (VOs);
- o GC/MS for semivolatile organics (SVOs);

- o gas chromatography/electron capture (GC/EC) analysis for DBCP;
- o inductively coupled plasma (ICP) screen for the metals cadmium, chromium, copper, lead, and zinc;
- o atomic absorption spectroscopy (AA) for arsenic; and
- o cold vapor atomic absorption spectroscopy (CVAA) for mercury.

More complete information on the soil analytical methods may be found in the report titled "Development and Evaluation of Analytical Methodologies Used in RMA Soil Investigations" (Ebasco, 1988k/RIC 88127R02). Some samples were also analyzed by high-performance liquid chromatography (HPLC) for thiodiglycol and agent degradation products.

In the ESA sites, the GC/MS analysis for VOs was applied only to samples from below the 0 to 1 ft depth interval, since these compounds are expected to volatilize from surface soils. VOs were normally not analyzed in samples collected outside of the ESA sites, as the samples from these other areas were composites of the 0 to 1 and 4 to 5 ft intervals.

The GC/MS method provided positive identification and semiquantitative concentration results for target analytes above the Certified Reporting Limit (CRL). The lower CRL is defined as the lowest concentration of analyte in the sample being analyzed that can be reported within a ninety percent confidence interval, using valid precision and accuracy criteria. The upper CRL is the maximum concentration of an analyte in the sample being analyzed that can be reported within a ninety percent confidence interval, using valid precision and accuracy criteria (USATHAMA, 1987). For the purposes of this report, "CRL" will refer to the lower CRL and "upper CRL" will refer to the maximum quantification limit.

Where GC/MS methods were used, nontarget compounds were tentatively identified by establishing a "best fit" identification using a computer library of spectra. Some of these compounds were been added to the list of target compounds that are evaluated in the

SARs. Non-target compounds were added to the list of target compounds based on the following criteria:

- Fully identified according to analytical technique;
- Arsenal-activity or fuel-component related, rather than naturally occurring;
- Moderate to high carcinogenicity and/or toxicity, as outlined in the Chemical Index (Ebasco, 1988d/RIC 88357R01);
- Frequency of occurrence and concentration;
- Co-occurrence with target compounds on a site-by-site basis.

These significant nontarget compounds are:

VHOs

1,1,2,2-tetrachloroethane
trichloropropene

VHCs

2-butoxyethanol
4-hydroxy-4-methyl-2-pentanone
1-methyl-1,3-cyclopentadiene
methylcyclohexane
2,2-oxybisethanol
2-pentanone

OPHGBs

phosphoric acid, tributyl ester
phosphoric acid, triphenyl ester

ONCs

caprolactam

PAHs

fluoroanthene
methylnaphthalene
phenanthrene
pyrene

SHOs

trichlorobenzene
hexachlorobenzene
hexachlorobutadiene
tetrachlorobenzene
pentachlorobenzene

Because the method used to identify these compounds has not been subjected to U. S. Army Toxic and Hazardous Materials Agency (USATHAMA) certification procedures, these compounds have no CRL. The lower limit of detection has been assumed to correspond to ten percent of the internal standard for the GC/MS methods used, which is 0.3 µg/g.

The GC/MS analyses for VOs and SVOs were certified by USATHAMA to detect a variety of analytes and to accomplish the Phase I objective of identifying contaminants present in the study area. Phase II methods were developed and certified for use in further quantifying the concentrations of the target compounds identified in Phase I. The Phase II methods were more sensitive GC methods certified for fewer compounds at lower reporting limits. In addition, approximately ten percent of the samples analyzed by GC methods were also analyzed by GC/MS for confirmation of the GC results.

The Phase I and II target and significant nontarget compounds, analytical methods used, and laboratory CRLs for soil are presented by analyte groups in Table ESA 2.1-1. The analyte groups detected in ESA soil samples include:

- o Volatile halogenated organics (VHO);
- o Volatile hydrocarbons (VHC);
- o Volatile aromatic organics (VAO);
- o Organosulfur compounds, mustard-agent related (OSCM);
- o Organosulfur compounds, herbicide related (OSCH);
- o Organophosphorus compounds, GB-agent related (OPHGB);
- o Fluoroacetic acid;
- o Polynuclear aromatic hydrocarbons (PAH);
- o Semivolatile halogenated organics (SHO);
- o Organochlorine pesticides (OCP);
- o Arsenic;
- o Mercury; and
- o ICP metals (cadmium, chromium, copper, lead, and zinc).

Four laboratories performed analyses on soil and water samples collected during the RI. The analytical and quality assurance techniques employed during certification of analytical methods in the separate laboratories led to the establishment of lower and upper limits of quantification that are method, analyte, laboratory, and instrument specific. Therefore, the reported CRL for a given sample may vary between samples. Lower CRLs for analytes detected during the RI fall within a range established by the most and least sensitive methods from among the four laboratories. This CRL range is presented for each analyte in soil samples in Table ESA 2.1-2. Data values falling below their respective CRLs are reported as below CRL (BCRL). The most and least sensitive methods among the four laboratories also define a range of upper CRLs; however, in some cases it was possible to report a value greater than the upper CRL while maintaining the USATHAMA quality of the data. To accomplish this, samples with higher contaminant concentrations were diluted so that the instrument reading for the diluted sample fell within the upper CRL range, and only exceeded this range when the dilution factor was applied to arrive at the final result. Data for these diluted samples represent the only values above the upper CRL that can be reported with the degree of accuracy and precision required by USATHAMA.

In cases where analytical values exceeded the upper CRL and the samples were not diluted, an attempt was made to recover the actual instrument readings from the laboratory. This information was used to gain a qualitative understanding of the relative level of contamination in the samples. These results that were above the upper CRL are not of USATHAMA quality and cannot be used with the same confidence as those falling within the quantification limits.

To provide a complete review of information pertinent to the contamination assessment at RMA, data from investigations other than the RI have been included in this and previous reports where appropriate, even though the methods used were not USATHAMA certified. This use has set a precedent to consider non-USATHAMA quality data along with the USATHAMA quality results obtained under the RI.

The inclusion of non-USATHAMA quality data was also done in consideration of the fact that sophisticated statistical manipulations of the data would not be carried out for the purposes of the SARs. Such manipulations were deemed inappropriate considering the large numbers of values that fell below the various CRLs as well as those values (estimated to be approximately one percent of the data set) that fell above the upper CRLs and were not the result of approved dilution procedures. It was determined that statistical manipulations of more limited data sets, such as those obtained from a single site, would be more appropriate and accurate for the FS. In the FS phase, more limited statistical evaluations could then be used to evaluate, on a case-by-case basis, the effects of the non-USATHAMA quality or out-of-range data on the contamination assessment and on the evaluation and selection of appropriate remedial measures.

2.1.2 Analytical Results

In order to present the analytical data in a summary form for this report, contaminant distribution maps are constructed by analyte group rather than by individual analyte. Analyte groups reflect similar chemical composition, physical/chemical properties, and origins; and are discussed in generally decreasing order of mobility. Data were grouped together in continuous depth intervals which encompass the standard sampling intervals. To further simplify the presentation of the analyte levels, ranges of concentrations are shown by dots of different sizes.

Separate maps were used to represent the results for soil samples falling into the 0 to 2, 2 to 5, 5 to 20, and greater than 20 ft depth intervals. Composite samples from the 0 to 1 and 4 to 5 ft intervals are shown on both the 0 to 2 and 2 to 5 ft interval maps.

Because the depth intervals used in analytic distribution maps may encompass more than one sample interval, one dot may represent more than one sample from a given soil boring. A single dot may also represent from one to all of the analytes detected in an analyte group at a given location. For these reasons, the number of dots on a map may be less than the number of samples analyzed.

For the organic compounds, the soils data reported for each boring were separated into the depth intervals used in the maps. Next, the data were separated into analyte groups. To compute the total concentration of each group in the boring, the highest concentration of each analyte in the group was summed. The resulting sum is equal to or greater than the total concentration of that group in any one sample. This worst-case concentration is represented on the map by the dot size corresponding to the concentration range attained.

The concentrations for each analyte group were divided into several ranges, and represented by progressively larger dots. The concentration ranges were based upon the following criteria:

Organics: (a) Lowest CRL to 1.0 $\mu\text{g/g}$.

(b) 1.0 $\mu\text{g/g}$ to next order of magnitude.

(c) Subsequent ranges based on orders of magnitude, not to exceed four ranges per map.

Inorganics: (a) Upper end of indicator range (i.e., the indicator level) to nearest order of magnitude.

(b) Subsequent ranges increase by a single order of magnitude above the previous concentration range.

Organic compounds associated with RMA activity are not naturally occurring, so detections were generally considered to be of environmental significance. For this reason, the indicator level for these compounds was considered to be the individual CRL. The metals are naturally occurring, so an indicator range of expected natural concentrations was established. Details on the selection of indicator ranges may be found in the Introduction to the CARs (ESE, 1987a/RIC 88204R02). The indicator ranges for metals reflect the concentrations expected to occur naturally in RMA alluvial soils. The upper limits of these ranges are:

Metal Concentration ($\mu\text{g/g}$)

Arsenic 10

Cadmium 2.0

Chromium 40

Copper 35

Lead 40

Mercury 0.10

Zinc 80

Arsenic and mercury are mapped individually. The ICP metals, cadmium, chromium, copper, lead, and zinc, are mapped as a group.

Each ICP metal has a different indicator range and therefore cannot be compared directly on the basis of absolute concentration. For this reason, and because these metals tended to occur together in the ESA, the ICP concentrations are not added together to give a total for plotting. Instead, they were compared to their indicator ranges and assigned to a relative range. The highest range attained by any one ICP metal in a given depth interval is represented on the map. The indicator ranges for each metal are listed under Range 1. The metal specific concentration ranges in $\mu\text{g/g}$, are based on the indicator ranges, as follows:

<u>Metal</u>	<u>Range 1</u>	<u>Range 2</u>	<u>Range 3</u>	<u>Range 4</u>
Cadmium	BCRL-2.0	2.0-10	10-100	> 100
Chromium	BCRL-40	40-100	100-1,000	> 1,000
Copper	BCRL-35	35-100	100-1,000	> 1,000
Lead	BCRL-40	40-100	100-1,000	> 1,000
Zinc	BCRL-80	80-1,000	1,000-10,000	> 10,000

Because metals concentrations at or below the upper limits of the indicator ranges are considered to be consistent with natural conditions, results that do not exceed these indicator ranges are shown on the analyte distribution maps as open circles, like BCRL results. Values above the indicator ranges are shown as solid dots. The significance of

the metals concentrations greater than their indicator ranges is discussed further in the contamination assessment portion of this report (Section 3.0).

In addition to the presentation of these data on the analyte distribution map, a summary list of the compounds detected above the CRLs in ESA soils and sediments is presented by site group and by analyte group in Table ESA 2.1-2. These results represent the sample concentrations of each analyte, less any concentration detected in the method blanks.

2.1.3 Distribution of Analytes

This section discusses the occurrence of target and significant nontarget compounds by analyte group in ESA soil.

2.1.3.1 Volatile Halogenated Organics (VHOs)

In the ESA, 14 of a total of 192 soil samples analyzed contained concentrations of at least one of the VHO compounds above the CRL. Detections ranged from 0 to 30 ft in depth, and 0.3 to 4 $\mu\text{g/g}$ in concentration. The six compounds of the VHO group present were chloroform, 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, trichloroethylene, tetrachloroethylene, and trichloropropene. Methylene chloride was also detected in the ESA, but is discussed separately due to its potential occurrence as a laboratory artifact. Figures ESA 2.1-1 through 2.1-4 illustrate the location, depth ranges, and concentration ranges of VHO detections in the study area.

There are four site groups that contained detections of VHOs in the ESA. ESA-2, the burial trench sites, had one detection in the 2 to 5 ft interval, five detections in the 5 to 20 ft interval, and two detections in the 20 ft or greater interval. These occurred in the refuse cells of ESA-2b, the sanitary landfill (Site 30-4), and in ESA-2a, the Section 32 burn pits (Sites 32-5 and 32-6). The toxic storage sites had one detection in the 0 to 2 ft interval, two detections in the 2 to 5 ft interval, and one in the 5 to 20 ft interval. The tentative identification of 1,1,2,2-tetrachloroethane detected in the 0 to 2 ft interval of ESA-3c, the Section 31 toxic storage yard (Site 31-4), was a suspected misidentification

because this volatile compound was not expected to remain in surface soil for an extended period of time. In the balance of investigations, the nontarget compound trichloropropene was detected in the 0 to 2 ft interval from Section 25. Volatile compounds were not analyzed in this sample.

In the ESA, seven of a total of 162 soil samples analyzed for methylene chloride indicated concentrations above the CRL. Detections ranged from 4 to 33 ft in depth, and were all 1 $\mu\text{g/g}$ in concentration. Figures ESA 2.1-5 through 2.1-7 illustrate the location, depth ranges, and concentration ranges of methylene chloride detections in the study area.

All detections of methylene chloride occurred in ESA-2b, the Section 30 sanitary landfill (Site 30-4). Four detections were noted in the 2 to 5 ft interval, one in the 5 to 20 ft interval, and two in the 20 ft or greater interval. The two detections in the 20 ft or greater interval occurred in the same boring, and are therefore represented by one dot. For five of the detections, the next deeper sampling interval was not analyzed for methylene chloride.

It should be noted that the detections of methylene chloride were all at a concentration of 1 $\mu\text{g/g}$. Methylene chloride is a common laboratory contaminant.

2.1.3.2 Volatile Hydrocarbons and Related Compounds (VHCs)

In the ESA, 30 of a total of 1,120 soil samples analyzed for the VHC group indicated concentrations above the CRL. Detections ranged from 0 to 10 ft in depth, and 0.3 to 4 $\mu\text{g/g}$ in concentration. The two members of the group present were the nontarget compounds 2-butoxyethanol and 2,2-oxybisethanol. Figures ESA 2.1-8 through 2.1-10 illustrate the location, depth ranges, and concentration ranges of VHC detections in the ESA. Fifteen of the detections were from samples composited from the 0 to 1 and 4 to 5 ft intervals. These detections are shown on both the 0 to 2 and 2 to 5 ft interval dot maps. Two borings with detections in the 2 to 5 ft interval of ESA-1c, the Section 29 surface burn (Site 29-1), are within close proximity, and appear as one dot.

Of the 30 VHC detections in the study area, 28 were 2,2-oxybisethanol.

2,2-oxybisethanol is more commonly known as diethylene glycol, a compound used widely in antifreeze. This compound was detected in the following depths and sites: 0 to 10 ft in ESA-1c and ESA-1d, the Section 29 and 30 burn sites (Sites 29-1 and 30-2); 0 to 5 ft in ESA-4a, the Section 30 impact area (Site 30-1); and 0 to 5 ft in the nonsource areas of Section 29 and 30. These detections are suspected field procedure contaminants, because during cold weather, antifreeze was put in the steam cleaner overnight and bled out of the lines before use. The steam cleaner was used to decontaminate equipment between samples. It is strongly suspected that this procedure caused drilling and sampling equipment to be contaminated with antifreeze, which was then transmitted to the samples. All Task 14 borings in Sections 19, 20, 29 and 30, where detections of 2,2-oxybisethanol occurred were drilled during cold weather.

The two remaining VHC detections in the ESA occurred in one boring in ESA-3b, the Section 6 toxic storage yard (Site 6-6). The compound 2-butoxyethanol was detected in the 0 to 2 ft interval at 0.3 $\mu\text{g/g}$, and in the 2 to 5 ft interval at 0.3 $\mu\text{g/g}$, the lowest concentrations reported for the group. Samples were not obtained from this boring below the 2 to 5 ft interval.

2.1.3.3 Volatile Aromatic Organic Compounds (VAOs)

In the ESA, 16 of a total of 196 soil samples analyzed contained concentrations of at least one of the VAO compounds above the CRL. Detections ranged from 0 to 30.2 ft in depth, and 0.1 to 5 $\mu\text{g/g}$ in concentration. The four members of the group present were benzene, toluene, o-xylene, p-xylene, and m-xylene. Figures ESA 2.1-11 through 2.1-14 illustrate the location, depth ranges, and concentration ranges of VAO detections in the ESA. There were three detections in the 2 to 5 ft interval at the sanitary landfill. For one boring in both the Section 30 storage shed plots and the Section 32 burn pits, two detections occurred in the 5 to 20 ft interval. These detections are represented by a single dot at each site at that depth interval.

The highest and lowest concentrations detected were 5 $\mu\text{g/g}$ and 0.14 $\mu\text{g/g}$, respectively, in the 2 to 5 ft interval from ESA-2b, the sanitary landfill (Site 30-4). Of the 16 VAO detections, six were not analyzed for the same compound in the next interval. One detection of xylene from the 0 to 2 ft interval of ESA-1a, the Section 19 surface burn (Site 19-1), and one detection of toluene from the 0 to 2 ft interval of the Section 20 nonsource area were target analytes identified in nontarget screening.

There are four site groups that contained soil sample detections of VAOs in the ESA. ESA-1, the surface burn sites, had one detection in the 0 to 2 ft interval. ESA-2, the burial trench sites, had five detections in the 2 to 5 ft interval, four detections in the 5 to 20 ft interval, and two detections in the 20 ft or greater interval. ESA-3, the toxic storage sites, contained one detection in the 2 to 5 ft interval and two detections in the 5 to 20 ft interval. The balance of investigations had one detection in the 0 to 2 ft interval of Section 20.

2.1.3.4 Organosulfur Compounds, Mustard-Agent Related (OSCMs)

In the ESA, 20 of a total of 1,138 soil samples analyzed for the OSCM group indicated concentrations above the CRL. Detections ranged from 0 to 10 ft in depth and 0.6 to 330 $\mu\text{g/g}$ in concentration. The four compounds of the OSCM group detected in the study area were chloroacetic acid, dithiane, 1,4-oxathiane, and thiodiglycol. Figures ESA 2.1-15 through 2.1-18 illustrate the location, depth ranges, and concentration ranges of OSCM detections in this study area. In ESA-3a, the Section 5 storage yard (Site 5-2), and the northwest corner of ESA-3d, the Section 31 storage shed plots (Site 31-7), multiple detections in the 0 to 2 ft interval are represented by what appears to be single dots. This is due to their close proximity. For this reason and the concentration summing protocol, only nine dots representing detections appear in Figures ESA 2.1-15 to 2.1-18.

All OSCM detections in the ESA were in the toxic storage sites. Twelve detections, including the highest concentration, were noted in the 0 to 2 ft interval; four in the 2 to 5 ft interval; and three in the 5 to 20 ft interval. One detection of chloroacetic acid in

the 5 to 20 ft interval of ESA-3a, the Section 5 toxic storage yard (Site 5-2), at a concentration of 120 $\mu\text{g/g}$, was in a saturated sample. Samples were not collected below that depth. For all the detections, the compounds detected in the 2 to 5 and 5 to 20 ft depth intervals were not analyzed for in the next sampling interval. The frequency of detections diminish with depth, and detections are located in areas where potential leaks from agent-filled bombs occurred.

2.1.3.5 Organosulfur Compounds, Herbicide Related (OSCHs)

In the ESA, four of a total of 1,138 soil samples analyzed for the OSCH group contained concentrations above the CRL. Detections ranged from 0 to 20 ft in depth, and 0.5 to 9 $\mu\text{g/g}$ in concentration. The three members of the group present were benzothiazole, chlorophenylmethyl sulfone, and chlorophenylmethyl sulfoxide. Figures ESA 2.1-19 through 2.1-22 illustrate the location, depth ranges, and concentration ranges of OSCH detections in the study area. The dot in the 5 to 20 ft interval (Figure ESA 2.1-21) represents two detections within that interval.

One detection of benzothiazole was tentatively identified in the nontarget screening. The sample was collected from the 0 to 1 ft interval, at a concentration of 0.5 $\mu\text{g/g}$, in a boring from ESA-1a, the Section 19 burn site (Site 19-1). Phase II samples collected within 50 ft of this boring did not detect benzothiazole even though more sensitive analysis methods were employed. One detection of chlorophenylmethyl sulfoxide was noted in the 0 to 2 ft interval in ESA-3d, the Section 31 toxic storage plots (Site 31-7). The compound was detected on the edge of storage plot 23, in a sample that also contained a mustard degradation product. Two detections of chlorophenylmethyl sulfone occurred in samples collected from one boring in the 5 to 20 ft interval in ESA-2b, the sanitary landfill (Site 30-4). A geophysical survey identified a sanitary landfill waste cell at this boring location.

2.1.3.6 Organophosphorus Compounds, GB-Agent Related (OPHGBs)

In the ESA, one of a total of 716 soil samples analyzed for the OPHGB group indicated a concentration above the CRL. The single compound detected was isopropylmethyl

phosphonic acid at a depth of 9 to 10 ft and a concentration of 47 $\mu\text{g/g}$. The sample was located in ESA-3c, the Section 31 toxic storage yard (Site 31-4), next to a concrete pad used for demilitarization of VX-filled spray tanks. The concrete pad is west of and isolated from the primary storage yard. Samples analyzed from the intervals above and below this detection tested below the CRL for isopropylmethyl phosphonic acid. A 1973 report suggested that VX was spilled on the ground at this site, although the exact location was not verified (Blackwell, 1973/RIC 81339R20). Figures ESA 2.1-23 and 2.1-24 represent the location of the boring containing isopropylmethyl phosphonic acid in the study area.

2.1.3.7 Fluoroacetic Acid

In the ESA, five of a total of 50 soil samples analyzed for fluoroacetic acid indicated concentrations above the CRL. Detections ranged from 0 to 5 ft in depth and 2.7 to 19 $\mu\text{g/g}$ in concentration. Figures ESA 2.1-25 through ESA 2.1-27 illustrate the location, depth ranges, and concentration ranges of fluoroacetic acid detections in the study area.

The highest concentration of fluoroacetic acid was noted in one surface sample taken from a man-made mound in ESA-2c, the Section 30 open trenches (Site 30-6). Two detections were noted in samples from trenches in the 2 to 5 ft interval at ESA-4a, the Section 30 impact area (Site 30-1). ESA-5, the demilitarization activity site (Site 30-5), contained one detection in a sample within the 0 to 2 ft interval, next to a building where fuzes were removed from agent-filled bombs. Although not documented, it is conceivable that these bombs leaked during the fuze removal process. The lowest concentration of fluoroacetic acid detected in the study area was in a sample from the 0 to 2 ft interval in the nonsource area investigation of Section 25. This sample was collected from a drainage ditch leading from the North Plants Study Area. For all samples that detected fluoroacetic acid in the ESA, the next deepest sample analyzed was below the CRL for the compound.

2.1.3.8 Polynuclear Aromatic Hydrocarbons (PAHs)

In the ESA, six soil samples detected the PAH group in nontarget GC/MS screening.

Detections were only in the 0 to 1 ft sampling interval, and ranged from 0.5 to 20 $\mu\text{g/g}$ in concentration. PAH detections occurred in ESA-1a, 1b, and 1c, the Section 19, 20, and 29 burn sites (Sites 19-1, 20-1, and 29-1). The two members of the group present were methylnaphthalene and phenanthrene, which are significant nontarget compounds. Figures ESA 2.1-28 and 2.1-29 illustrate the location, depth ranges, and concentration ranges of PAH detections in the study area. The larger dot in the 0 to 2 ft interval of the Section 29 surface burn represents two detections.

2.1.3.9 Semivolatile Halogenated Organics (SHOs)

In the ESA, one of a total of 1,106 soil samples analyzed for the SHO group contained concentrations above the CRL of 0.3 $\mu\text{g/g}$. Hexachlorobenzene, a nontarget compound, was detected in a surface sample from the Section 20 nonsource area investigation at a concentration of 0.5 $\mu\text{g/g}$. Hexachlorobenzene is also known as "Bunt-cure," a common seed and soil fungicide, which may be related to crops planted in Section 20. Further information may be found in the Contamination Assessment Report for Section 20, Nonsource Area (ESE, May 1988k/RIC 88173R06).

2.1.3.10 Organochlorine Pesticides (OCPs)

In the ESA, four of a total of 1,106 soil samples analyzed for the OCP group detected concentrations above the CRL. Detections ranged from 4 to 15 ft in depth and 0.003 to 20 $\mu\text{g/g}$ in concentration. The two members of the group present were aldrin and dieldrin. Figures ESA 2.1-30 through 2.1-33 illustrate the location, depth ranges, and concentration ranges of OCP detections in the study area. In the 5 to 20 ft depth interval, one dot in the sanitary landfill represents three detections.

ESA-2b, the sanitary landfill (Site 30-4), and ESA-2c, the Section 30 open trenches (Site 30-6), had the only OCP soil sample detections in the ESA. There was one detection of dieldrin in the 2 to 5 ft interval of a boring adjacent to the open trenches and two of aldrin and one of dieldrin in the 5 to 20 ft interval of the sanitary landfill. Of the two samples from the landfill, the one containing aldrin was not analyzed for the same compound in the next sampling interval.

2.1.3.11 Arsenic

In the ESA, 18 of a total of 1,142 soil samples analyzed for arsenic contained concentrations above the upper indicator level of 10 $\mu\text{g/g}$. Detections ranged from 0 to 20 ft in depth and 11 to 270 $\mu\text{g/g}$ in concentration. Figures ESA 2.1-34 through 2.1-37 illustrate the location, depth ranges, and concentration ranges of arsenic detections above the indicator range in the study area.

Of the detections above its indicator range, the highest concentrations of arsenic, falling within the 100 to 1,000 $\mu\text{g/g}$ dot size range, were noted in two surface samples collected from ESA-3b, the Section 6 toxic storage yard (Site 6-6). Three samples in this site had concentrations in the 10 to 100 $\mu\text{g/g}$ range. Other detections in designated sites within the 10 to 100 $\mu\text{g/g}$ range were: one each for ESA-1c and 1d, the Section 29 and 30 surface burns (Sites 29-1 and 30-2); two in ESA-4b, the Section 29 demolition area (Site 29-4); and one in ESA-2c, Section 30 open trenches (Site 30-6). These concentration ranges for one sample in Section 20, five samples in Section 25, and two samples in Section 30 were also detected during the nonsource area investigations.

2.1.3.12 Mercury

In the ESA, 15 of a total of 1,111 soil samples analyzed for mercury contained concentrations above the upper indicator range of 0.10 $\mu\text{g/g}$. Detections ranged from 0 to 20 ft in depth and 0.11 to 0.81 $\mu\text{g/g}$ in concentration. Figures ESA 2.1-38 through 2.1-41 illustrate the location, depth ranges, and concentration ranges of mercury detections above the indicator range in the study area.

Of the mercury detections above its indicator range, the highest concentrations were noted in two samples collected from ESA-2b, the sanitary landfill (Site 30-4). These occurred in the 0.10 to 1.0 $\mu\text{g/g}$ range. Other detections at this concentration range were: two in ESA-1c, the Section 29 surface burn (Site 29-1); four in ESA-4b, the Section 29 demolition area (Site 29-4); and one in the Section 30 open trenches (Site 30-6). The balance of investigations showed this concentration range for one sample in Section 25; four samples in Section 30 (former Site 30-3); and one sample in Section 31.

2.1.3.13 ICP Metals

In the ESA, 150 of a total of 1,188 soil samples analyzed for ICP metals contained concentrations above the indicator level. All of the ICP metals, cadmium, chromium, copper, lead, and zinc, were detected. Detections ranged from 0 to 40 ft in depth, and the maximum concentration detected was 57,000 $\mu\text{g/g}$ of zinc. Figures ESA 2.1-42 through 2.1-45 illustrate the location, depth ranges, and concentration ranges of ICP metal detections above the upper indicator level in the ESA.

As illustrated by the figures, ICP metals were detected above the upper indicator level in all the ESA site groups. Many of the detections were only slightly above the upper indicator level. However, ESA-2a, the Section 32 burn pits, had the highest concentrations of ICPs in the study area. Concentrations of lead and zinc were as high as 3,400 $\mu\text{g/g}$ and 57,000 $\mu\text{g/g}$ in the 0 to 2 ft interval, and 2,100 $\mu\text{g/g}$ and 15,000 $\mu\text{g/g}$ in the 5 to 10 ft interval of this site. The lower depth corresponds to the base of the burning pit. Surficial samples from the surface burns in Sections 20, 29, and 30 and the Section 31 storage shed plots also contained high concentrations of ICP metals.

There were seven ICP metal samples which were well above their upper indicator levels, but were still within the next concentration range. The majority of these samples were collected from the 0 to 2 ft depth interval, and occurred in the following sites: ESA-2a, the Section 32 burn pits (Site 32-6); ESA-2b, the sanitary landfill (Site 30-4); ESA-3c, the Section 31 storage yard (Site 31-4); ESA-3d, the Section 31 storage shed plots (Site 31-6); and an area in the southwest corner of Section 29 (Site 29-5). The remaining high concentration samples were collected from the 5 to 20 ft depth interval, and occurred in the following two sites: a location in Section 30 east of ESA-5, the bomb demilitarization site (Site 30-5); and ESA-1c, the Section 29 surface burn (Site 29-1).

2.1.3.14 Compounds Not Detected

The following compounds were not detected in the soil sampling program at the ESA:

organophosphorus compounds, pesticide related, and DBCP. Organophosphorus compounds were analyzed in 1,048 samples and DBCP was analyzed in 1,122 samples.

2.2 SURFACE WATER CONTAMINANTS

Samples of surface water were collected from seven locations along First Creek (Figure ESA 2.2-1). Sampling was conducted quarterly, from October 1985 to September 1987, as part of the Task 4 and 44 surface and groundwater quality screening programs. Complete surface water analytical data is presented in the Water RI Report (Ebasco, 1989/RIC 89067R08). Both this section, concerning surface water, and the following section, concerning groundwater, summarize the water quality results from Task 4 (ESE, 1988k/RIC 88173R06; ESE, 1987b/RIC 87253R01), and Task 44 (ESE, 1988n/RIC 88244R02). The groundwater discussion also includes information from Task 25 (ESE, 1988bb/RIC 89024R02). Locations of surface water sampling sites were chosen to monitor specific regions of the ESA. Station 8-001 monitors water quality entering the ESA, and Station 24-002 monitors it leaving the ESA. Station 24-007 monitors for the influence of potential runoff from the sewage treatment plant in Section 24. Station 30-002 was located to monitor the influence of surface water entering First Creek from the North Plants complex. Station 31-002 monitors water quality upstream of the Section 31 toxic storage sites, and Station 31-001 checks it downstream. Station 5-001 provides monitoring of water quality in the southern portion of Section 5.

2.2.1 Analytical Methods and Detection Limits

During the two years of surface water and groundwater quality sampling used for this report, the analytical suite expanded from 24 to 66 compounds. This was in response to the ongoing water quality monitoring programs and input from the Army, USEPA, Shell Oil Company, and the State of Colorado. From October 1985 to September 1986, the Task 4 analytical suite was used. From October 1986 to September 1987, the Task 44 analytical suite was used. These suites were originally designed to screen for historically detected contaminants found in the ESA. The site specific sampling conducted in Section 31 and 32 during January 1989 sampled a unique suite of analytes based on compounds detected in nearby soil samples.

Samples collected from October 1985 to September 1986 as part of Task 4 were originally analyzed for 24 target compounds. The analyte list was modified at several stages and at the end of the program consisted of 50 compounds. All analytical methods used were quantitatively certified according to USATHAMA methods to obtain low CRLs and high accuracy. The target compounds, analytical methods, and laboratory CRLs for the final analyte list of Task 4 are presented in Table ESA 2.2-1.

Samples collected from October 1986 to September 1987 as part of Task 44 were analyzed for the same fifty compounds used in Task 4, plus benzothiazole and chlordane. Semiquantitative GC/MS methods were used for an additional list of 42 compounds, 27 of which were also included in the quantitative screening. DBCP was analyzed by both quantitative and semi-quantitative methods. The Task 44 analytical program was applied to both surface and groundwater and was adapted into the Task 25 program, which monitored wells in Section 24 of the ESA. The target compounds, analytical methods, and laboratory CRLs for the final analyte list of Task 44 are presented in Table ESA 2.2-2.

The analytical suite proposed in Tasks 4, 44 and 25 in technical plans varied somewhat in surface water and groundwater samples collected in the ESA. The specific list of compounds analyzed for in a given sample may be obtained in the reports for Tasks 44 and 25 (ESE, 1988k/RIC 88173R06; ESE, 1987b/RIC 87253R01; ESE, 1988n/RIC 88244R02; and ESE, 1983dd/RIC 89024R02).

2.2.2 Analytical Results

A summary list of the target and significant nontarget compounds detected above the CRL in surface water samples is presented by analyte group in Table ESA 2.2-3. The associated contaminant distribution maps for surface water are presented in Figures ESA 2.2-2 through 2.2-6. The contaminant distribution maps use the dot format to present relative analyte concentrations for surface water and were constructed using the following procedures. No organic compounds were detected more than once at any

station and ICP metals were detected more than once at only two stations. For a given station, the highest detection of an individual analyte noted during the sampling program was represented on the maps. Within a given organic analyte group, the detections of individual analytes were summed to reach the concentration range represented by the dots. For the ICP metals, the highest individual range attained by an analyte at a station was represented, and no summing procedure was used. Because of these procedures, the data used for the maps represent a worst-case scenario.

2.2.3 Distribution of Analytes

This section discusses the distribution of analytes detected in ESA surface water samples and describes data presented in Table 2.2-3. During the two years that surface water stations were sampled in the ESA, repeated detections of analytes were not common.

2.2.3.1 Volatile Halogenated Organics (VHOs)

In the ESA, chloroform and chlorobenzene were the only VHOs detected during the surface water sampling program. Chloroform was detected at Station 31-002, during the July to September 1986 sampling, at a concentration of 3.5 $\mu\text{g/l}$. It was not detected during the previous sampling period, from April to June 1986; the station was not sampled during the following two fiscal year quarters, from October 1986 to March 1987. Chlorobenzene was detected at Station 31-001, during the April to June 1986 sampling, at a concentration of 1.8 $\mu\text{g/l}$. It was not detected during the previous sampling period from October 1985 to March 1986; the station was not sampled during the following three quarters, from July 1986 to March 1987. A total of thirty-four surface water samples were collected from the ESA and analyzed for VHO compounds. Figure ESA 2.2-2 illustrates the location and concentration of VHO detections in the study area.

2.2.3.2 Organophosphorus Compounds, GB-Agent Related (OPHGBs)

In the ESA, diisopropylmethyl phosphonate was the only OPHGB compound detected during the surface water sampling program. The compound was detected at Stations 8-001 and 24-002, at concentrations of 11 and 17 $\mu\text{g/l}$, during the initial sampling from October 1985 to March 1986. Station 8-001 was sampled during the following six

quarters, from April 1986 to September 1987; and Station 24-002 was sampled during the following quarter, from April to June 1986. Detections of diisopropymethyl phosphonate were not repeated at these stations. A total of thirty-four surface water samples were collected from the ESA and analyzed for OPHGB compounds. Figure ESA 2.2-3 illustrates the location and concentration of OPHGB detections in the study area.

2.2.3.3 Organochlorine Pesticides (OCPs)

In the ESA, three detections of aldrin and two detections of dieldrin were the only OCPs noted during the surface water sampling program, as follows:

<u>Compound</u>	<u>Station</u>	<u>Detections/</u> <u>Samples</u>	<u>Concentration</u> <u>($\mu\text{g/l}$)</u>	<u>Date</u> <u>of Sampling</u>
Aldrin	8-001	1/10	0.20	12/85
Dieldrin	8-001	1/10	0.060	11/85
Aldrin	24-002	1/6	0.20	12/85
Dieldrin	24-002	1/6	0.080	11/85
Aldrin	31-001	1/4	0.080	12/85

Aldrin and dieldrin were detected at Station 8-001, during the initial sampling from October 1985 to March 1986, at respective concentrations of 0.20 and 0.060 $\mu\text{g/l}$. The detections were not repeated during the following six sampling quarters, from April 1986 to September 1987. Aldrin and dieldrin were also detected at Station 24-002, during the initial sampling from October 1985 to March 1986, at respective concentrations of 0.20 and 0.080 $\mu\text{g/l}$. The detections were not repeated in the following sampling period, from April to June 1986. Finally, aldrin was detected at Station 31-001, during the initial sampling from October 1985 to March 1986, at a concentration of 0.080 $\mu\text{g/l}$. The detection was not repeated in the following sampling quarter, from April to June 1986.

A total of thirty-four surface water samples were collected from the ESA and analyzed for OCP compounds. Figure ESA 2.2-4 illustrates the location and concentration of OCP detections in the study area.

2.2.3.4 Arsenic

In the ESA, five detections of arsenic were noted during the surface water sampling program, as follows:

<u>Compound</u>	<u>Station</u>	<u>Detections/</u> <u>Samples</u>	<u>Concentration</u> <u>($\mu\text{g/g}$)</u>	<u>Date of</u> <u>Sampling</u>
Arsenic	8-001	1/7	6.6	4/86
Arsenic	5-001	1/2	3.8	5/87
Arsenic	31-002	1/2	7.3	5/87
Arsenic	24-007	1/1	5.0	5/87
Arsenic	24-002	1/2	3.5	6/87

One detection occurred at Station 8-001 during the sampling from April to June 1986 at a concentration of 6.6 $\mu\text{g/l}$. Arsenic was not detected at this station during the previous sampling, from October 1985 to March 1986; nor during the following five sampling quarters from July 1986 to September 1987. Detections of arsenic occurred in Stations 5-001 and 31-002 during the sampling from April to June 1987, at respective concentrations of 3.8 and 7.3 $\mu\text{g/l}$. These stations were not sampled during the previous two quarters from October 1986 to March 1987; they were sampled without arsenic detections during the following quarter from July to September 1987. A detection occurred at Station 24-007 during the April to June 1987 sampling, at a concentration of 5.0 $\mu\text{g/l}$. This station was not sampled at any other time during the program. Finally, an arsenic detection was noted at Station 24-002 during the April to June 1987 sampling at a concentration of 3.5 $\mu\text{g/l}$.

A total of twenty surface water samples were collected from the ESA and analyzed for arsenic. None of the sample stations contained multiple arsenic detections. Figure ESA 2.2-5 illustrates the location and concentration of arsenic detections in the study area.

2.2.3.5 ICP Metals

Zinc was detected at sample stations located near the east and north boundaries of the ESA. For multiple detections, the highest concentration and its sampling date are presented in this summary. Cadmium and copper were detected at Station 8-001 during

the January to March 1987 sampling period, at respective concentrations of 14 and 21 $\mu\text{g/l}$. These compounds were not detected at this station during the previous five sampling quarters from October 1985 to December 1986; nor during the following two sampling quarters from April to September 1987. Chromium and lead were also detected at Station 8-001 during the final sampling from July to September 1987, at respective concentrations of 13 and 22 $\mu\text{g/l}$. These detections were not repeated during the previous seven sampling quarters from October 1985 to June 1987. Zinc was detected twice at Station 8-001, first during the April to June 1986 sampling at a concentration of 24 $\mu\text{g/l}$ and second during the October to December 1986 sampling at a concentration of 25 $\mu\text{g/l}$. Zinc was not detected during the intervening sampling period from July to September 1986 nor during the previous period from October 1985 to March 1986. Zinc was not detected during the following three quarters from January to September 1987. Zinc was detected twice at Station 24-002 in two sampling events conducted during April to June 1986, at concentrations of 41 and 30 $\mu\text{g/l}$. It was not detected during the previous sampling from October 1985 to March 1986; and the station was not sampled during the following two quarters from July to December 1986. Finally, copper was detected at Station 31-001 during the final sampling from July to September 1987 at a concentration of 10 $\mu\text{g/l}$. It was not detected during the previous sampling quarter from April to June 1987. A total of twenty surface water samples were collected from the ESA and analyzed for ICP metals. Figure ESA 2.2-6 illustrates the location and concentration of ICP metal detections in the study area, summarized as follows:

<u>Compound</u>	<u>Station</u>	<u>Detections/ Samples</u>	<u>Highest Concentration ($\mu\text{g/l}$)</u>	<u>Date of Sampling</u>
Cadmium	08-001 (08ADD)	1/7	14	3/87
Copper	08-001 (08ADD)	1/7	21	3/87
Chromium	08-001 (08ADD)	1/7	13	10/87
Lead	08-001 (08ADD)	1/7	22	10/87
Zinc	08-001 (08ADD)	2/7	25	12/86
Zinc	24-002 (13DCC)	2/3	41	6/87
Copper	31-001	1/2	10	10/87

2.2.3.6 Compound Groups Not Detected

The following compound groups were analyzed for but not detected in the ESA surface water sampling program: VHCs, VAOs, OSCMs, OSCHs, OPHPs, DBCP, SHOs, and mercury. Surface water samples were not analyzed for fluoroacetic acid.

2.3 GROUNDWATER CONTAMINANTS

Samples of groundwater were collected from two distinct hydrologic systems in the ESA, the alluvial aquifer and Denver Formation groundwater. Table ESA 2.3-1 summarizes the detections of target and significant nontarget compounds, by individual analyte, in both hydrologic systems. Table ESA 2.3-2 presents the analytes detected in all sampling events by individual well, for alluvial groundwater samples. Table ESA 2.3-3 presents the analytes detected in all sampling events by individual well, for Denver Formation groundwater samples. This section will discuss the alluvial and Denver hydrologic systems separately.

2.3.1 Alluvial Aquifer Sampling Network

The sampling network for the alluvial aquifer consisted of the nineteen wells shown in Figure ESA 2.3-1. The first two digits of the well number represent the section, and the last three represent the individual well. The well network was chosen to provide information on compounds historically detected in groundwater in the ESA, as well as to provide overall hydrologic information on the study area. Historical water quality was derived from information summarized in the Water RI Report (Ebasco, 1989/RIC 89067R08). Wells 08002 and 08003 monitor water quality entering the ESA from off-post and were sampled to verify historical concentrations of OCPs and diisopropylmethyl phosphonic acid. Well 07001 is near the southern boundary of the ESA by the Highline Lateral, an area where OCPs were historically detected. Wells 06002 and 06003 were sampled to verify historical concentrations of OCPs and diisopropylmethyl phosphonic acid. Well 31005 is in the vicinity of First Creek and was sampled to verify historical concentration of diisopropylmethyl phosphonic acid and DBCP. Well 31005 provided water quality data for the west-central portion of the ESA. Well 32001 is generally

downgradient of ESA-2a, the Section 32 burn pits (Sites 32-5 and 32-6), and is also within a minor paleochannel which enters the ESA in Section 32. Wells 25011, 25038, and 30009 were sampled to provide verification of historical OCP, DBCP, and diisopropylmethyl phosphonic acid concentrations and to give an indication of general alluvial aquifer water quality in the northeastern portion of RMA. Wells 19001, 24107, 24166, 24183, and 24188 were sampled to provide information on conditions in the vicinity of the North Boundary Containment System. Finally, Wells 31014, 31015, and 31016 were sampled to specifically monitor conditions downgradient from the Section 31 Toxic Storage Area; and Well 32004 was sampled to specifically monitor conditions downgradient from the Section 32 Burn Pits. These wells were installed late in the RI to address site-specific monitoring needs. They were sampled once during January 1989. At the time of publication of this report, the data from these new wells had not completed final quality assurance/quality control procedures. The preliminary data from these wells are included in Appendix ESA-C to assist the characterization of contaminants in the alluvial aquifer. Further sampling of these wells is being carried out under the Comprehensive Monitoring Program.

The number of ESA alluvial aquifer wells sampled in the RI generally decreased during the life of the program. Ten wells were sampled from October 1985 to March 1986, seven wells were sampled from April to June 1986; nine wells were sampled from July to September 1986; three wells were sampled from October to December 1986 and from January to March 1987; thirteen wells were sampled from April to June 1987; three wells were sampled from July to September 1987; and five wells were sampled in January 1989. The reason for the general decrease in sampling over time was the lack of analyte detections. Table ESA 2.3-1 summarizes the detections that occurred in the alluvial aquifer water quality monitoring program.

The dot map format is used in the contaminant distribution maps to represent relative analyte concentrations in alluvial groundwater samples. These maps were constructed using the following procedures. Repeat detections of analytes were not common during the groundwater sampling program in the ESA. For a given well, the highest

concentration of an individual analyte detected in all sampling periods was represented on the maps. Within a given organic analyte group, the highest detections of individual analytes were summed to reach the concentration range represented by the dots. For the ICP metals, the highest individual range attained by an analyte at a well was represented, and no summing procedure was used. Because of these procedures, the data used for the maps represent a worst-case scenario.

2.3.2 Analytical Results of Alluvial Aquifer Sampling

A list of all the target compounds detected above the CRL in alluvial aquifer groundwater samples is presented by analyte group in Table ESA 2.3-2. A total of fifty-two alluvial aquifer groundwater samples were collected and analyzed for target contaminants during the RI. The associated contaminant distribution maps for the alluvial aquifer are presented in Figures ESA 2.3-2 to 2.3-8. Due to the low frequency of repeat detections, the highest concentration from any sampling period is represented on the figures. Increasing dot sizes indicate increases in the magnitude of contaminant concentrations.

2.3.3 Distribution of Analytes in the Alluvial Aquifer

This section presents the analytes detected in the alluvial aquifer, and their frequency of occurrence. It summarizes data presented in Tables ESA 2.3-1 and 2.3-2.

2.3.3.1 Volatile Halogenated Organics (VHOs)

In the ESA, chlorobenzene, chloroform, and 1,2-dichloroethane were noted in the alluvial aquifer sampling program, as follows:

<u>Compound</u>	<u>Well</u>	<u>Detections/ Samples</u>	<u>Concentration ($\mu\text{g/l}$)</u>	<u>Date of Sampling</u>
Chlorobenzene	06002	1/4	1.4	Sp 87
Chlorobenzene	07001	1/4	1.9	Sp 87
Chlorobenzene	08003	1/3	0.74	Sp 87
1,2-Dichloroethane	08003	1/3	0.64	Sp 87
Chloroform	24188	1/5	22	Wi 87
Chloroform	30009	1/4	60	Su 86
Chloroform	31014	1/1	0.58	Wi 89
Chloroform	31016	1/1	3.7	Wi 89

Chlorobenzene was detected in Wells 06002, 07001, and 08003 during the April to June 1987 sampling. Wells 06002 and 07001 were not sampled during the previous two periods from October 1986 to March 1987; Well 08003 was not sampled during the previous three quarter periods from July 1986 to March 1987. None of the three wells was sampled during the one quarter period following the detection, July to September 1987. 1,2-Dichloroethane was detected in Well 08003 during the April to June 1987 sampling. This well was not sampled during the three previous sampling periods from July 1986 to March 1987, nor during the following sampling period from July to September 1987. Chloroform was detected in Well 24188 during the January to March 1987 sampling. There were no detections of chloroform at this well during the previous two quarter periods from July to December 1986 or the following two quarter periods from April to September 1987. Chloroform was detected in Well 30009 during the July to September 1986 sampling. The well was sampled without any detections during the previous three quarter period from October 1985 to June 1986. The well was not sampled during the following two quarter period from October 1986 to March 1987. Chloroform was detected in Wells 31014 and 31016 during the site-specific sampling in January 1989. As noted in Section 2.3.1, data from these wells has not completed the

final quality assurance/quality control procedures, and is therefore considered preliminary. Figure ESA 2.3-2 illustrates the location and concentration of VHO detections in the study area.

2.3.3.2 Volatile Aromatic Organics (VAOs)

In the ESA, benzene and toluene were the only VAOs detected in the alluvial aquifer sampling program, as follows:

<u>Compound</u>	<u>Well</u>	<u>Detections/</u> <u>Samples</u>	<u>Highest</u> <u>Concentration</u> <u>($\mu\text{g/l}$)</u>	<u>Date of</u> <u>Sampling</u>
Benzene	06002	1/4	2.4	Sp 86
Toluene	24188	1/5	8.6	Fa 86

Benzene was detected in Well 06002 during the April to June, 1986 sampling. There were no detections of benzene during the previous two quarter periods from October 1985 to April 1986 nor the following one quarter period from July to September 1986. Toluene was detected in Well 24188 during the October to December 1986 sampling. The well was sampled with no detections of toluene during the previous one quarter period from July to September 1986 nor any during the following three quarter period from January to September 1987. Figure ESA 2.3-3 illustrates the location and concentration of VAO detections in the study area.

2.3.3.3 Organosulfur Compounds Herbicide Related (OSCHs)

In the ESA, chlorophenylmethyl sulfone and chlorophenylmethyl sulfoxide were the only OSCHs detected during the alluvial aquifer sampling program, as follows:

<u>Compound</u>	<u>Well</u>	<u>Detections/</u> <u>Samples</u>	<u>Highest</u> <u>Concentration</u> <u>($\mu\text{g/l}$)</u>	<u>Date of</u> <u>Sampling</u>
Chlorophenyl- methyl sulfone	24183	4/5	3.7	Sp 87
Chlorophenyl- methyl sulfoxide	24183	1/5	6.1	Fa 86
Chlorophenyl- methyl sulfone	24188	3/5	4.3	Fa 86

Chlorophenylmethyl sulfone was detected in Well 24183 four times in the four quarters of sampling from October 1986 to September 1987. The highest concentration of the four detections is reported above although all concentration values are reported in Table ESA 2.3-2. Chlorophenylmethyl sulfoxide was also detected in Well 24183 once during the sampling from October to December 1986. The well was sampled without any detections during the previous quarter from July to September 1986.

Chlorophenylmethyl sulfone was detected in Well 24188 three times during the three quarters of sampling from October 1986 to June 1987. The well was sampled with no detections during the previous quarter from July to September 1986. The well was sampled with no OSCH detections during the following quarter from July to September 1987. Figure ESA 2.3-4 illustrates the location and concentration of OSCH detections in the study area.

2.3.3.4 DBCP

In the ESA, DBCP was detected once during the alluvial aquifer sampling program, as follows:

<u>Compound</u>	<u>Well</u>	<u>Detections/ Samples</u>	<u>Concentration ($\mu\text{g/l}$)</u>	<u>Date of Sampling</u>
DBCP	24183	1/5	0.16	Wi 87

DBCP was detected in Well 24183 during the January to March 1987 sampling. The well was sampled with no detection of DBCP detections during the two previous quarters from July to December 1986, and during the two following quarters from April to September 1987. Figure ESA 2.3-5 illustrates the location and concentration of the DBCP detection in the study area.

2.3.3.5 Organochlorine Pesticides (OCPs)

In the ESA, aldrin, dieldrin, and endrin were the only OCPs detected during the alluvial aquifer sampling program, as follows:

<u>Compound</u>	<u>Well</u>	<u>Detections/ Samples</u>	<u>Highest Concentration ($\mu\text{g/l}$)</u>	<u>Date of Sampling</u>
Aldrin	32001	1/2	0.11	Wi 86
Aldrin	31016	1/1	0.11	Jan 89
Dieldrin	24166	5/5	0.16	Fa 86
Dieldrin	24183	1/5	0.087	Su 87
Dieldrin	31016	1/1	0.27	Jan 89
Endrin	08003	1/3	0.074	Jan 86
Endrin	31016	1/1	0.18	Jan 89

Aldrin was detected in Well 32001 during the sampling from October 1985 to March 1986. This was the initial sampling period. There were no detections at this well during the following sampling quarter from April to June 1986. Dieldrin was detected in Well 24166 during the five sampling quarters in July 1986 to September 1987. The well was not sampled during the three previous sampling quarters from October 1985 to June 1986. Dieldrin was also detected in Well 24183 during the sampling period from July to September 1987. No dieldrin detections were reported for this well during the previous four sampling quarters from July 1986 to June 1987. Endrin was detected in Well 08003 during the initial sampling period from October 1985 to March 1986. No detections were noted during the following quarter from April to June 1986. Figure ESA 2.3-6 illustrates the location and concentration of OCP detections in the study area. Aldrin was detected in Well 31016 during the site-specific sampling in January 1989. Dieldrin was detected in Well 31016 during the site-specific sampling in January 1989. Endrin was detected in Well 31016 during the site-specific sampling in January 1989. As noted in Section 2.3.1, data from these wells has not completed the final quality assurance/quality control procedures, and is therefore considered preliminary.

2.3.3.6 Arsenic

In the ESA, arsenic was detected three times during the alluvial aquifer sampling program, as follows:

<u>Compound</u>	<u>Well</u>	<u>Detections/</u> <u>Samples</u>	<u>Concentration</u> <u>μg/l)</u>	<u>Date of</u> <u>Sampling</u>
Arsenic	24107	1/2	5.3	Su 86
Arsenic	24183	1/5	4.7	Su 87
Arsenic	24188	1/5	5.1	Su 87

Arsenic was detected in Well 24107 during the sampling from July to September 1986. The well was not sampled during the previous three quarters from October 1985 to June, 1986 nor during the following two sampling periods from October 1986 to March 1987. Arsenic was not detected during sampling of the well during April to June 1987. Arsenic was detected in Wells 24183 and 24188 during the sampling from July to September 1987. The analyte was not detected in either of the wells during the previous four sampling periods from July 1986 to June 1987. Figure ESA 2.3-7 illustrates the location and concentration of arsenic detections in the study area.

2.3.3.7 ICP Metals

In the ESA, all the ICP metals were detected during the alluvial aquifer sampling program, as follows:

<u>Compound</u>	<u>Well</u>	<u>Detections/</u> <u>Samples</u>	<u>Concentration</u> <u>(μg/l)</u>	<u>Date of</u> <u>Sampling</u>
Zinc	06002	1/1	41	Sp 87
Chromium	06003	1/1	7.3	Sp 87
Zinc	06003	1/1	110	Sp 87
Cadmium	07001	1/1	12	Sp 87
Chromium	07001	1/1	37	Sp 87
Copper	07001	1/1	30	Sp 87
Lead	07001	1/1	24	Sp 87
Zinc	07001	1/1	97	Sp 87
Chromium	08003	1/1	11	Sp 87
Chromium	19001	1/1	8	Sp 87
Chromium	24107	1/1	26	Sp 87
Zinc	24107	1/1	93	Sp 87
Chromium	25011	1/1	12	Sp 87
Zinc	25038	1/1	53	Sp 87
Chromium	30009	1/1	16	Sp 87
Zinc	30009	1/1	140	Sp 87
Chromium	31005	1/1	23	Sp 87
Zinc	31005	1/1	43	Sp 87

ICP metals were detected only during the sampling from April to June 1987 in the following wells: 06002, 06003, 07001, 08003, 19001, 24107, 25011, 25038, 30009, and 31005. In each case this was the only time during the RI that the samples were analyzed for ICP metals. Figure ESA 2.3-8 illustrates the location and concentration of ICP metals in the study area.

2.3.3.8 Compound Groups Not Detected

The following compound groups were not detected in the alluvial aquifer sampling program in the ESA: VHCs, OSCMs, OPHGBs, OPHPs, DBCP, ONCs, PAHs, SHOs, and mercury. Groundwater samples were not analyzed for fluoroacetic acid.

2.3.4 Denver Formation Groundwater Sampling Network

The sampling network for the Denver Formation groundwater consisted of the 37 wells shown in Figure ESA 2.3-9. Well locations were chosen to provide information on compounds detected historically in the ESA, as well as to provide information on ESA sites. Wells 07004, 07005, 08004, and 08005 monitored the quality of Denver Formation groundwater as it entered RMA from off-post. Wells 06004, 06005, and 05001 were sampled to verify historical concentrations of diisopropylmethyl phosphonic acid, and Wells 05002 and 05003 were sampled to provide information on water quality entering the ESA from the southeast. Wells 25012, 25013, 25014, 29002, 29003, 30004, 30005, 30010, 30011, 31006, 31007, 31008, 32002, 32003, 06004, 06005, 08004, 08005, 05001, 05002, and 05003 are cluster wells corresponding to alluvial aquifer monitoring wells. These wells provided information on aquifer interactions and any potential soil or groundwater contamination of the alluvial aquifer and Denver Formation groundwater. Wells 19003, 19015, 19016, 19017, 19018, and 19019 were sampled to monitor water quality at the northern border of the ESA. Well 31002 provided information on the western portion of the ESA and potential influence of groundwater from the Central Study Area. Wells 24108, 24109, 24120, 24174, and 24175 provided information on contaminant concentrations in the vicinity of the North Boundary Containment System.

The number of Denver Formation groundwater wells sampled in the RI in the ESA generally decreased during the life of the program. Thirty wells were sampled from October 1985 to March 1986. Sixteen wells were sampled from April to June 1986. Eighteen wells were sampled from July to September 1986. Five wells were sampled from October to December 1986 and from January to March 1987. Eighteen wells were sampled from April to June 1987. Finally, five wells were sampled from July to September 1987. The reason for the general decrease in sampling over time was the lack of analyte detections. Table ESA 2.3-2 summarizes the detections that occurred in the Denver Formation groundwater quality monitoring program.

2.3.5 Analytical Results of Denver Formation Groundwater Sampling

A summary list of all the target and significant nontarget compounds detected above the

CRL is presented by analyte group in Table ESA 2.3-3. A total of forty-seven Denver Formation groundwater samples were obtained and analyzed for target contaminants during the RI. The associated contaminant distribution maps for the Denver Formation groundwater are presented in Figures ESA 2.3-10 to 2.3-16. The presentation strategy is similar to that for the alluvial aquifer data, discussed in Section 2.3.2. Detections of the same compound group in different members of a cluster well site resulted in a single dot on the contaminant distribution map.

2.3.6 Distribution of Analytes in Denver Formation Groundwater

This section presents the analytes detected in Denver Formation groundwater and their frequency of occurrence. It summarizes data presented in Table ESA 2.3-3.

2.3.6.1 Volatile Halogenated Organics (VHOs)

In the ESA, chlorobenzene, chloroform, methylene chloride, and trichloroethylene were detected in the Denver Formation groundwater sampling program, as follows:

<u>Compound</u>	<u>Well</u>	<u>Detections/ Samples</u>	<u>Highest Concentration ($\mu\text{g/l}$)</u>	<u>Date of Sampling</u>
Chlorobenzene	24174	3/5	45	Su 86
Trichloroethylene	24174	1/5	2.4	Su 86
Chlorobenzene	24175	3/5	25	Su 86
Methylene Chloride	24175	1/5	4.3	Fa 86
Chloroform	30011	1/4	20	Su 86

Chlorobenzene was detected in Wells 24174 and 24175 during the one sampling period from July to September 1986 and the two last sampling periods from April to September 1987. The highest concentrations of multiple chlorobenzene detections are reported above, although all concentration values are reported in Table ESA 2.3-3. The wells were not sampled prior to the first detection and were sampled without chlorobenzene

detections in the two sampling periods from October 1986 to March 1987.

Trichloroethylene was also detected in Well 24174 during the sampling period from July to September 1986. No sampling was conducted prior to this, and trichloroethylene was not detected in the following four sampling periods, from October 1986 to September 1987. Methylene chloride was also detected in Well 24175 during the sampling period from July to September 1986. The well was sampled without methylene chloride detections in the prior quarter, April to June 1986 and during the three periods from January to September 1987. Chloroform was detected in Well 30011 during one sampling quarter from July to September 1986. No chloroform was detected in the prior three sampling quarters from October 1985 to June 1986. Well 30011 was not sampled in the following two quarters, from October 1986 to March 1987. Figure ESA 2.3-10 illustrates the location and concentration of the VHO detections in the study area, and Figure ESA 2.3-11 illustrates the methylene chloride detection.

2.3.6.2 Volatile Aromatic Organics (VAOs)

In the ESA, benzene was the only VAO detected in the Denver Formation groundwater sampling program. It was found in the following wells:

<u>Compound</u>	<u>Well</u>	<u>Detections/</u> <u>Samples</u>	<u>Highest</u> <u>Concentration</u> <u>(µg/l)</u>	<u>Date of</u> <u>Sampling</u>
Benzene	06005	1/4	10	Wi 86
Benzene	07004	1/4	8.9	Su 86
Benzene	07005	2/3	4.2	Su 86
Benzene	19015	1/4	7.3	Wi 86
Benzene	19016	1/3	1.4	Wi 86
Benzene	24174	2/5	20	Su 86
Benzene	24175	2/5	4.5	Su 86
Benzene	25040	1/1	2.1	Wi 86
Benzene	32002	1/2	1.8	Wi 86

Benzene was detected in Wells 06005, 19015, and 19016 during the initial sampling period from October 1985 to March 1986. For these wells, benzene was not detected in the following two sampling periods from April to September 1986. Benzene was also detected in Wells 25040 and 32002 during the initial sampling period from October 1985 to March 1986. These wells were not sampled in the following four quarters from April 1986 to March 1987. Benzene was detected twice in Wells 24174 and 24175, first during the July to September 1986 sampling and second during the final sampling from July to September 1987. The highest concentration of multiple detections is reported above although all concentration values are reported in Table ESA 2.3-3. No benzene detections were noted during the intervening three sampling periods from October 1986 to June 1987. These wells were not sampled during the prior three periods, from October 1985 to June 1986. Benzene was detected in Well 07004 during the July to September 1986 sampling period. No detections were noted during the previous three sampling periods from October 1985 to June 1986. The well was not sampled in the following two quarters from October 1986 to March 1987. Finally, benzene was detected twice in Well 07005 during the two quarters from April to September 1986. No detections were noted in the previous two sampling periods from October 1985 to March 1986. The well was not sampled in the following four quarters from October 1986 to September 1987. Figure ESA 2.3-12 illustrates the location and concentration of benzene detections in the study area.

2.3.6.3 DBCP

In the ESA, DBCP was detected twice in the Denver Formation groundwater sampling program, as follows:

<u>Compound</u>	<u>Well</u>	<u>Detections/ Samples</u>	<u>Concentration ($\mu\text{g/l}$)</u>	<u>Date of Sampling</u>
DBCP	06005	1/4	0.75	Wi 86
DBCP	24174	1/5	0.15	Su 86

DBCP was detected in Well 06005 during the initial sampling from October 1985 to March 1986. There were no detections in the following two quarters from April to September 1986. It was also detected in Well 24174 during the sampling from July to September 1986. The well was not sampled during the previous three quarters from October 1985 to June 1986. DBCP was not detected in the following four quarters from October 1986 to September 1987. Figure ESA 2.3-13 illustrates the location and concentrations of DBCP detections in the study area.

2.3.6.4 Organochlorine Pesticides (OCPs)

In the ESA, the OCPs aldrin, endrin, and dieldrin were detected in the Denver Formation groundwater samples, as follows:

<u>Compound</u>	<u>Well</u>	<u>Detections/ Samples</u>	<u>Highest Concentration ($\mu\text{g/l}$)</u>	<u>Date of Sampling</u>
Aldrin	25014	1/4	0.46	Wi 86
Dieldrin	25014	1/4	0.42	Wi 86
Endrin	30005	1/2	0.12	Wi 86
Aldrin	31006	1/3	0.15	Wi 86
Dieldrin	19003	1/1	8.9	Sp 87
Endrin	19003	1/1	0.20	Sp 87
Dieldrin	19019	1/2	0.064	Wi 86
Endrin	19019	1/2	0.092	Wi 86
Dieldrin	24120	5/5	0.19	Fa 86
Aldrin	25013	1/4	0.17	Wi 86

Aldrin was detected in Wells 25013 and 31006, and aldrin and dieldrin were detected in Well 25014 during the initial sampling period from October 1985 to March 1986. There was no detection of these compounds in the following two sampling quarters from April

to September 1986. Dieldrin and endrin were detected in Well 19019, and endrin was detected in Well 30005 during the initial sampling from October, 1985 to March 1986. There were no detections during the following sampling quarter from April to June 1986. Dieldrin and endrin were detected in Well 19003 during the sampling from April to June 1987. This well was not sampled during any other quarter in this program. Dieldrin was detected five times in Well 24120 during the five quarters from July 1986 to September 1987. The highest concentration of the five detections is reported above, although all concentration values are reported in Table ESA 2.3-2. The well was not sampled during the previous three quarters from October 1985 to June 1986. Figure ESA 2.3-14 illustrates the location and concentration of OCP detections in the study area.

2.3.6.5 Arsenic

In the ESA, arsenic was detected ten times in the Denver Formation groundwater sampling program, as follows:

<u>Compound</u>	<u>Well</u>	<u>Detections/ Samples</u>	<u>Highest Concentration ($\mu\text{g/l}$)</u>	<u>Date of Sampling</u>
Arsenic	06004	1/4	2.6	Sp 87
Arsenic	08004	1/1	5.9	Wi 86
Arsenic	08005	1/2	2.6	Sp 87
Arsenic	19015	1/4	6.8	Wi 86
Arsenic	19016	1/3	26	Wi 86
Arsenic	24109	1/5	8.6	Su 86
Arsenic	24174	2/5	3.9	Su 87
Arsenic	24175	1/5	4.1	Sp 87
Arsenic	32002	1/2	20	Wi 86

Arsenic was detected in Well 06004 during the April to June 1987 sampling. The well was not sampled during the previous two quarters from October 1986 to March 1987, nor during the following quarter from July to September 1987. Arsenic was detected in Well 08004 during the October 1985 to March 1986 sampling period. The well was not sampled in any other quarter. Arsenic was detected in Well 08005 during the April to June 1987 sampling. The well was not sampled during the previous four quarters from April 1986 to March 1987 nor during the following quarter from July to September 1987. Arsenic was detected in Wells 19015 and 19016 during the initial sampling from October 1985 to March 1986. It was not detected in the following two quarters from April to September 1986. Arsenic was detected in Well 24109 during the July to September 1986 quarter. This well was not sampled during the previous three quarters from October 1985 to June 1986. There were no detections during the following four sampling quarters from October 1986 to September 1987. Arsenic was detected twice in Well 24174, during the sampling from January to March 1987, and during the final sampling from July to September 1987. It was not detected in the intervening quarter from April to June 1987, nor was it detected in the previous two quarters from July to December 1986. Arsenic was detected in Well 24175 during the sampling from April to June 1987. It was not detected in the previous three sampling quarters from July 1986 to March 1987, nor in the following sampling quarter from July to September 1987. Finally, arsenic was detected in Well 32002 during the initial sampling period from October 1985 to March 1986. There were no detections of arsenic in the only other sample collected from this well, from April to June 1987. Figure ESA 2.3-15 illustrates the location and concentration of arsenic detections in the study area.

2.3.6.6 ICP Metals

In the ESA, the ICP metals chromium, copper, lead, and zinc were detected in the Denver Formation groundwater sampling program. Detections were as follows:

<u>Compound</u>	<u>Well</u>	<u>Detections/</u> <u>Samples</u>	<u>Highest</u> <u>Concentration</u> <u>(μg/l)</u>	<u>Date of</u> <u>Sampling</u>
Chromium	05001	1/1	16	Sp 87
Copper	05001	1/1	9.7	Sp 87
Zinc	05001	1/1	74	Sp 87
Zinc	08004	1/1	36	Wi 86
Zinc	08005	1/2	42	Sp 87
Chromium	19003	1/1	43	Sp 87
Zinc	19003	1/1	60	Sp 87
Chromium	19015	1/2	13	Sp 87
Copper	19015	1/2	17	Sp 87
Zinc	19015	1/2	43	Wi 86
Zinc	19016	1/1	33	Wi 86
Chromium	19017	1/1	13	Sp 87
Zinc	19017	1/1	300	Sp 87
Zinc	24120	1/1	35	Sp 87
Zinc	25013	3/3	82	Sp 86
Zinc	25039	2/2	23	Sp 87
Zinc	25040	1/1	34	Wi 86
Copper	31002	1/1	33	Sp 86
Lead	32002	1/1	65	Sp 87
Zinc	32002	1/2	34	Sp 87

Chromium, copper, and zinc were detected in Well 05001; zinc was detected in Well 08004; chromium and zinc were detected in Well 19017; and lead and zinc were detected in Well 32002 during the sampling from April to June 1987. For all these wells, ICP metals were only analyzed for during this sampling. Zinc was also detected in Well 08005 during the sampling period from April to June 1987. This well had also been sampled in the initial sampling period from October 1985 to March 1986, and zinc was not detected. Chromium and zinc were detected in Well 19003 during the April to June

1987 period. The well was not sampled at any other time in this program. Zinc was detected in Wells 19015 and 19016 during the initial sampling from October 1985 to March 1986. ICP metals were not analyzed for during the following two quarters from April to September 1986. Chromium and copper were also detected in Well 19015 during the sampling from April to June 1987. This well was not sampled during the previous two quarters from October 1986 to March 1987 nor was it sampled during the following quarter from July to September 1987. Zinc was detected in Well 24120 during the sampling from April to June 1987. ICP metals were not analyzed for during the previous three sampling quarters from July 1986 to March 1987 nor during the following sampling quarter from July to September 1987. Zinc was detected three times in Well 25013, twice during the sampling from April to September 1986 and once during the sampling from April to June 1987. Samples from this well were not analyzed for ICP metals during the intervening two quarters from October 1986 to March 1987, nor during the following quarter from July to September 1987. ICP metals were not analyzed for in Well 25013 during the initial sampling from October 1985 to March 1986. Zinc was detected twice in Well 25039, once during the initial sampling from October 1985 to March 1986, and once during the sampling from April to June 1987. The well was not sampled at any other time during the program. Finally, zinc was detected in Well 25040 during the initial sampling from October 1985 to March 1986 and copper was detected in Well 31002 during the April to June 1986 sampling. These wells were not sampled at any other time during the program. Figure ESA 2.3-16 illustrates the location and concentration of ICP metal detections in the study area. Table ESA 2.3-3 lists the Denver wells, dates when groundwater samples were collected, and compounds detected in the samples. ICP metal detections are included in this list, and those samples which were analyzed for ICP metals are indicated by a plus sign on the table.

2.3.6.7 Compound Groups Not Detected

The following compound groups were not detected in the Denver Formation groundwater sampling program in the ESA: VHCs, OSCMs, OSCHs, OPHGBs, OPHPs, ONCs, PAHs, SHOs, and mercury. Groundwater samples were not analyzed for fluoroacetic acid because no certified analysis method for this compound was developed.

2.4 STRUCTURES CONTAMINANTS

On the basis of use history and a visual survey, all ESA structures were classified as to their suspected contamination classification. The locations and identification numbers of structures existing in the ESA are presented in Plate ESA 1.3-1. Four structures in the ESA are suspected to be contaminated, thirty-six are suspected to be contaminated but cleanable, and twenty-two are suspected to be uncontaminated. All four of the structures suspected to be contaminated are located in the Section 31 toxic storage sites. Based on visual observation, 14 structures are suspected to contain asbestos. No structures in the ESA contained process equipment at the time of the Structures Survey for the RI, conducted in the spring of 1987. A summary of the contaminant classification of structures in the ESA is presented in Table ESA 2.4-1. Further information on structures contamination may be found in the Structures Survey Final Summary of Results Report (Ebasco, 1988w/RIC 88306R02).

2.5 AIRBORNE CONTAMINANTS

Twelve air quality monitoring stations were located at RMA during the Air Remedial Investigation (ESE, 1988s/RIC 88263R01). One of these stations, AQ4, was located in the ESA. Station AQ4 was located along the northern edge of Section 5, as shown in Figure ESA 2.5-1. Total suspended particulates were monitored at this station and the other eleven stations at RMA. Particulate matter less than 10 microns (Pm-10), asbestos, and metals were also monitored at selected stations throughout RMA. Volatile and semivolatile organic compounds were evaluated during event monitoring near Basin A and Basin F. Table ESA 2.5-1 summarizes the analytical results from total suspended particulate monitoring at Station AQ4.

At Station AQ4, the analytical geometric average concentration of three individual total suspended particulate samples was 43 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). This is below the Federal and State secondary ambient air quality standard of $60 \mu\text{g}/\text{m}^3$. Only three individual total suspended particulate samples were collected because of equipment failure. The range of individual 24 hour concentrations for these samples was from 39 to

47 $\mu\text{g}/\text{m}^3$. The maximum 24 hour concentration of 47 $\mu\text{g}/\text{m}^3$ was below the Federal and state standard of 150 $\mu\text{g}/\text{m}^3$ (ESE, 1988s/RIC 88263R01).

The highest annual geometric average total suspended particulate concentration at RMA was 47 $\mu\text{g}/\text{m}^3$, along the northwest boundary in Section 27. The highest individual 24 hour total suspended particulate concentration at RMA was 150 $\mu\text{g}/\text{m}^3$, south of the South Plants Study Area (ESE, 1988s/RIC 88263R01). Higher concentrations were generally noted near the boundaries of RMA as compared to levels monitored at interior sites.

2.5.1 Analytical Results

Station AQ4 was located in Section 5, approximately 2,000 ft west of the RMA east boundary as shown in Figure ESA 2.5-1. Total suspended particulate sampling only was conducted at AQ4 due to equipment failure. Particulate matter less than 10 microns (PM-10), asbestos, metals, and organics were not monitored in the ESA. The occurrence and distribution of total suspended particulates is discussed below.

2.5.2 Distribution of Total Suspended Particulates

Three total suspended particulate samples were collected at AQ4 in June and July 1986. After this time, equipment failure did not allow for reliable data collection. The observed total suspended particulate values were 31, 40, and 47 $\mu\text{g}/\text{m}^3$ which are far below the Federal and State 24 hour maximum limit of 150 $\mu\text{g}/\text{m}^3$ and the RMA maximum observed level of 150 $\mu\text{g}/\text{m}^3$. Air quality at AQ4 is expected to be similar to that at AQ1 and AQ2 in the Western and Southern Study Areas, respectively, in that the stations are near the RMA boundary and adjacent to off-post transportation corridors. In general, these stations realize higher total suspended particulate levels in the driest months from dirt roads than do the interior monitoring locations.

2.6 CONTAMINANTS IN BIOTA

A comprehensive biota assessment of all RMA contamination, both on-post and off-post, was initiated in 1985. This program was designed to determine what, if any, RMA

contaminants remained in the environment and constituted hazards to the regional biota. Although the basic approach was to measure contaminant levels in tissues in comparison to levels in off-post controls, valuable information was also obtained from samples collected by chance (e.g., raptors found dead on RMA and salvaged for analysis). The results of these analyses are discussed in conjunction with information on known and potential effects on biota and ecosystems of the ESA in Section 3.0 of this report. A detailed treatment of all aspects of the biota sampling, chemical analysis regime, contaminants considered, and pathways analysis is contained in the Biota Assessment Final Technical Plan (ESE, 1988m/RIC 88243R05) and the Biota RI Report (ESE, 1989a/RIC 89054R01).

2.6.1 Contaminants of Concern

Compounds selected as contaminants of concern to biota met the following criteria:

- o Present in the RMA environment above ambient concentrations;
- o Rated at least moderately toxic; and
- o Volume and persistence information indicate that the chemical was present in the environment in sufficient quantity or for a long enough period of time to pose a hazard to biota.

The thirty-nine contaminants finally selected for evaluation based on this approach are presented in Table ESA 2.6-1. Toxicity assessments were prepared for all contaminants of potential concern to biota and are available in the Biota RI Report (ESE, 1989a/RIC 89054R01). These assessments summarize pertinent information on the nature and extent of existing or potential hazards to wildlife. Data from the assessments were incorporated with information on the concentration and distribution of these contaminants in physical media to provide a quantitative evaluation of RMA contaminant hazards to biota for the ESA and are addressed in Section 3.3 of this document.

Seven contaminants identified as major contaminants of concern based on their presence in the biosphere (e.g., in physical media within 20 ft of the ground surface),

bioconcentration/bioaccumulation potential, and areal extent (more than 5 acres), were selected for detailed pathways analysis. These contaminants were: aldrin/dieldrin, arsenic, DBCP, endrin/isodrin, and mercury. Two major contaminants of concern were not analyzed in biological tissues. DBCP although toxic, does not bioaccumulate significantly, while isodrin, an analog of endrin, is converted to endrin by metabolic processes. Two additional contaminants, DDE and DDT, were analyzed because of their potential implication in adverse biological effects. The pathways approach was used to develop criteria levels in soil, water, and sediment for the protection of regional biota and to evaluate existing levels to determine the nature and extent of contaminant hazards to biota. The results of pathways analysis and bioaccumulation potential and known and potential effects on biota of the ESA are discussed in Section 3.3.

2.6.2 Sampling Program Completed in the ESA

The diversity of wildlife in this study area led to an equally diverse sampling effort, second only to the Southern Study Area. Control samples of sunflowers and morning glory were taken from Sections 19 and 20, respectively. Both earthworms and grasshoppers were collected as on-post control samples for comparison against contaminated sites. Black-tailed prairie dogs, cottontail rabbits, and mule deer were included in the sampling program for mammals, while regular sampling of pheasants and American kestrels occurred as well. Samples of chance found in the ESA were a coyote, a golden eagle, and a great horned owl. A map of biota sample locations in the ESA is presented in Figure ESA 2.6-1.

2.6.3 Contaminant Levels in Species Occurring in the ESA

Biota samples were prepared by homogenation and extraction procedures according to standard certified USATHAMA methods. GC/MS methods were used for the detection of pesticides, while AA methods were used for the determination of arsenic and mercury concentrations. The CRL for each of the seven major contaminants of concern in the biota program is presented in Table ESA 2.6-2.

Contaminant levels in RMA wildlife species found in the ESA are summarized in Tables ESA 2.6-3 and 2.6-4. Table ESA 2.6-3 summarizes the analytical results from plant and animal samples collected in accordance with technical plans. Table ESA 2.6-4 includes biota samples collected by chance and samples collected by the U. S. Fish and Wildlife Services (USFWS). While some of the samples of the wildlife listed in the tables were not taken from the study area, most of these species have been located or spend some time in the area.

2.6.3.1 Plants and Invertebrates

Plant samples and grasshoppers collected from the ESA contained no detectable level of contaminants. Earthworms had concentrations of arsenic in all eight samples, ranging from 0.62 $\mu\text{g/g}$ to 1.5 $\mu\text{g/g}$. Two of eight earthworm samples contained mercury concentrations of 0.25 $\mu\text{g/g}$ and 0.21 $\mu\text{g/g}$ and one sample also contained dieldrin and endrin at concentrations of 5 and 0.9 $\mu\text{g/g}$, respectively.

Preliminary statistical analysis of earthworm sample data using the Analysis of Variables techniques indicated significant differences among the three sites (on-post controls, off-post controls, on-post contaminated). Probability values were calculated from available data for defining significance. On-post controls were contrasted with off-post controls, and control samples were pooled and compared to samples from contaminated areas. Of all analytes detected in earthworms, only comparisons for arsenic yielded significant differences. On-post control samples collected from Section 5 of the ESA differed from off-post control samples and pooled control areas differed significantly ($0.05 \geq p > 0.01$, where p is probability) from contaminated sites. Due to the low sample sizes, differences between on-post control and contaminated sites may have remained undetected.

Statistical analyses were completed on all grasshopper samples taken from RMA and off-post locations (see Table ESA 2.6-3). Samples collected from Section 26 were contrasted with those collected from Section 36, on-post control in Sections 7 and 8 of the ESA were contrasted with off-post controls, and pooled data from control sites were

contrasted with pooled data from contaminated areas. None of the comparisons for mercury, DDE, and DDT differed significantly.

Arsenic data differed significantly between the two contaminated sites, and approached significance ($0.10 \geq p > 0.050$) for the comparison of pooled control and contaminated sites. Significance was obtained for comparisons of aldrin levels between contaminated sites but not between pooled contaminated and pooled control sites. Significance was obtained for comparisons of dieldrin levels between contaminated sites, pooled contaminated, and pooled controls, but not between on-post and off-post controls. For endrin, Section 36 values differed significantly from Section 26, but when pooled, these sites did not differ from either on-post or off-post controls.

2.6.3.2 Black-tailed Prairie Dogs

Nineteen samples of prairie dogs were collected from three different areas in the ESA (Figure 2.6-1): four samples were collected from the northwest corner of Section 19, ten from the northeast corner of Section 20, and five from the Section 31 toxic storage yard. Three of the fourteen samples from Sections 19 and 20 (the on-post control samples) contained concentrations of dieldrin at 0.06, 0.1, and 0.3 $\mu\text{g/g}$. No other analytes were detected in these samples. Of the five samples taken from the Section 31 toxic storage yard, all samples contained dieldrin from 0.06 $\mu\text{g/g}$ to 0.2 $\mu\text{g/g}$. One sample from this site also contained 4.2 $\mu\text{g/g}$ of arsenic.

Prairie dog samples were statistically contrasted by site and season. Seasonal differences were compared between Section 36, summer versus winter, and between on-post control areas, summer versus winter. Analysis of seasonal differences revealed that only dieldrin had significantly higher contaminant levels in summer than winter. All other seasonal contrasts were not significant. Section 36 (summer and winter combined) was then contrasted to the Section 31 toxic storage yard, while on-post control areas (summer and winter combined) were contrasted to off-post controls. A final comparison was made between pooled contaminated samples (Section 36 and the Section 31 toxic storage yard) and control sites (on and off-post). Dieldrin levels were significantly higher in samples

from Section 36 than in samples from the toxic storage yard and higher in samples from on-post controls than samples from off-post controls. Analysis of pooled samples for dieldrin revealed highly significant differences between contaminated sites and controls. Comparisons for mercury, aldrin, endrin, and arsenic failed to yield any significant differences, although arsenic approached significance ($0.10 \geq p > 0.050$) for the comparison of pooled control sites with pooled contaminated sites.

2.6.3.3 Cottontail Rabbits and Mule Deer

Seven samples of cottontail rabbit muscle were collected from carcasses obtained in Sections 19 and 20 of the ESA. No analytes were detected. Three mule deer were collected near First Creek in the ESA, but none of the tissue samples from these deer had detectable concentrations of analytes.

2.6.3.4 Kestrels and Pheasants

A total of nine American kestrel eggs were taken from the ESA. Two samples were found to contain 1 and 0.05 $\mu\text{g/g}$ of dieldrin. No other analytes were detected. No analytes were detected in the three kestrel fledgling carcasses taken from the ESA.

None of the statistical comparisons for aldrin, endrin, DDE, and DDT between contaminated and control sites showed any significant differences for kestrel eggs or carcasses. For mercury, no significant difference was observed between control and contaminated sites, but differences between eggs and juveniles were significant. In contrast, differences between control and contaminated sites for dieldrin were significant for both juveniles and eggs, while no difference was detected between age groups. Both eggs and juvenile kestrel samples contained higher levels of dieldrin on RMA than off-post; in fact, no dieldrin was detected in either egg or juvenile kestrel samples collected off-post.

Three ring-necked pheasant eggs were collected in the ESA, with samples containing 0.2, 0.2, and 0.1 $\mu\text{g/g}$ of dieldrin; no other analytes were detected. Nine samples of adult pheasant muscle were analyzed (from nine carcasses taken from the ESA), and no

analytes were detected. Two livers from adult pheasants were analyzed, with one sample containing 0.1 $\mu\text{g/g}$ of dieldrin.

Ring-necked pheasant samples were statistically contrasted by off-post control versus on-post contaminated areas, and by age groups (egg, juvenile, or adult). No significant differences in levels of mercury, aldrin, endrin, DDE, or DDT were obtained for any contrasts. No significant differences in levels of arsenic were detected between control and contaminated sites within any of the three age groups, but significant differences were revealed among age groups for arsenic. Juvenile pheasant samples collected, both on and off-post, contained significantly higher levels of arsenic. No adult or egg samples contained any detectable arsenic. In contrast, significant differences between control and contaminated sites for eggs and juvenile pheasant samples were obtained for dieldrin. The preliminary Analysis of Variables showed dieldrin was significant. No differences were observed in adult pheasant samples from control and contaminated sites, probably due to the small population sampled.

2.6.3.5 Samples of Chance and Supplemental Samples

Dieldrin was detected at 8 $\mu\text{g/g}$ in the liver of a coyote found dead in the ESA. No other analytes were detected. Brain and liver tissue was sampled in a great horned owl found dead near First Creek. The owl brain contained 10 $\mu\text{g/g}$ dieldrin, and 2 $\mu\text{g/g}$ DDE, while the liver contained 0.057 $\mu\text{g/g}$ mercury, 9 $\mu\text{g/g}$ dieldrin, and 5 $\mu\text{g/g}$ DDE. A golden eagle found on the RMA eastern border was sampled for brain and liver tissue, but no analytes were detected. Supplemental biota samples were provided by the USFWS, and both samples of chance and USFWS samples are summarized on Table ESA 2.6-4.

Complete tables and figures summarizing the contaminant levels found in all samples taken on RMA may be found in the RI Report for Biota (ESE, 1989/RIC 89054R01).

2.7 SUMMARY

Organic compounds detected in the soils of the ESA included a few detections near the

CRL of VHOs and VAOs and OSCM concentrations above the CRL at a few isolated spill sites. VHOs and VAOs were detected in ESA-2b, the sanitary landfill (Site 30-4), and ESA-3d, the Section 31 toxic storage plots (Sites 31-6 and 31-7). OSCMs were detected in ESA-3d, ESA-3b, and ESA-3a, the Section 31 toxic storage plots, the Section 6 toxic storage yard, and the Section 5 toxic storage yard (Sites 31-6 and 31-7, Site 6-6 and Site 5-2, respectively). No apparent concentration trends are associated with VHO or VAO concentrations, and distribution patterns indicative of spills are associated with the OSCM concentrations. Metals were detected throughout the ESA, usually within or slightly above their indicator ranges. Metal concentrations above indicator ranges were found in all the ESA sites except the Section 5 toxic storage yard, although the highest metal concentrations were detected in ESA-4c, the Section 29 trench and mound, ESA-1, the surface burn sites (Sites 19-1, 20-1, 29-1 and 30-2), and ESA-2a, the Section 32 burn pits (Sites 32-5 and 32-6).

Detections of VHOs, OPHGBs, OCPs, arsenic, and ICP metals were found in surface water monitoring of First Creek in the ESA. Concentrations were relatively low level, and no contaminant patterns were noted. Zinc was the only analyte detected twice during the sampling, at both stations 08-001 and 24-002. All other analyte detections were single, nonrepeated hits.

Detections of VHOs, VAOs, OSCHs, DBCP, OCPs, arsenic, and ICP metals were found in the alluvial aquifer groundwater. The majority of organic compound detections occurred in samples collected near the North Boundary Containment System, which is discussed in the North Central Study Area Report. Repeat detections of dieldrin occurred at Well 24166, and repeat detections of chlorophenylmethyl sulfone occurred at Wells 24183 and 24188. All other organic analyte detections were single, nonrepeated hits. In most instances, ICP metals were analyzed for only once in samples collected from each well. Evidence does not indicate contaminant plumes occur in the alluvial aquifer of the ESA.

Detections of VHOs, VAOs, DBCP, OCPs, arsenic and ICP metals were found in the Denver Formation groundwater. Repeat detections of dieldrin occurred at Well 24120, and repeat detections of benzene and chlorobenzene occurred at Wells 24174 and 24175. Benzene was detected in two samples from Well 07005. All other analyte detections were single, nonrepeated hits. In most instances, ICP metals were analyzed for only once in samples collected from each well. Evidence does not indicate contaminant plumes in Denver Formation groundwater in the ESA.

The distribution of contaminants in ESA surface water and groundwater may have been presented differently than the neighboring study areas. Due to the limited numbers of detections in surface water and in the alluvial and Denver Formation groundwater systems in the ESA, the maximum concentrations were presented on contaminant distribution maps. The Southern, South Plants, Central, North Plants, and North Central study areas each presented surface water and groundwater data uniquely, and direct comparison of groundwater contaminant distribution maps among study areas may not be possible.

All structures existing in the ESA were identified and categorized as either contaminated, contaminated but cleanable, or uncontaminated. Of the 62 structures in the ESA, four are suspected to be contaminated, 36 are suspected to be contaminated but cleanable, and 22 are suspected to be uncontaminated. Based on visual observation, 14 structures are suspected to contain asbestos.

Air monitoring showed that the total suspended particulates observed in the ESA were below the Federal and State secondary ambient air quality standards. The maximum twenty-four hour concentrations of total suspended particulates of the ESA monitoring station were also below Federal and State standards.

Generally low levels of contaminants were found in biota sampling in the ESA. Of the few detections of contaminants, dieldrin was the most commonly detected analyte, followed by endrin, aldrin, arsenic, mercury, and DDE.

Table ESA 2.1-1 Phase I and II Analytes and Certified Reporting Limits for Eastern Study Area Soil Samples. Page 1 of 6.

Analytical Groups/Analytes	Phase I				Phase II			
	Method	CAL	ESE	MRI	Method	CAL	ESE	DataChem
Volatile Halogenated Organics (VHOS)								
1,1-Dichloroethane	GC/MS	0.9	0.3	0.5	GC/HECD	-	0.049	0.074
1,2-Dichloroethane	GC/MS	0.3	0.3	0.4	GC/HECD	-	0.050	0.085
1,1-Dichloroethylene	GC/MS	-	-	-	GC/HECD	-	0.047	0.24
1,2-Dichloroethylene	GC/MS	0.3	0.3	0.8	GC/HECD	-	0.051	0.26
1,1,2,2-Tetrachloroethane*	GC/MS	0.3	0.3	0.3	GC/MS	-	0.3	0.3
1,1,1-Trichloroethane	GC/MS	0.3	0.3	0.5	GC/HECD	-	0.049	0.088
1,1,2-Trichloroethane	GC/MS	0.3	0.3	0.6	GC/HECD	-	0.050	0.26
Carbon tetrachloride	GC/MS	0.3	0.3	0.4	GC/HECD	-	0.052	0.12
Chlorobenzene	GC/MS	0.3	0.3	0.3	GC/HECD	-	0.051	0.20
Chloroform	GC/MS	0.3	0.3	0.7	GC/HECD	-	0.052	0.068
Methylene chloride	GC/MS	0.7	0.3	-	GC/HECD	-	0.50	3.7
Tetrachloroethylene	GC/MS	0.3	0.3	0.5	GC/HECD	-	0.051	0.27
Trichloroethylene	GC/MS	0.3	0.3	0.6	GC/HECD	-	0.050	0.14
Trichloropropene*	GC/MS	0.3	0.3	0.3	GC/MS	-	0.3	0.3
Volatile Hydrocarbons (VHCs)								
2-Butoxyethanol*	GC/MS	0.3	0.3	0.3	GC/MS	-	0.3	0.3
4-Hydroxy-4-methyl-2-pentanone*	GC/MS	0.3	0.3	0.3	GC/MS	-	0.3	0.3
1-Methyl-1,3-cyclopentadiene*	GC/MS	0.3	0.3	0.3	GC/MS	-	0.3	0.3
2,2-Oxybisethanol*	GC/MS	0.3	0.3	0.3	GC/MS	-	0.3	0.3
2-Pentanone*	GC/MS	0.3	0.3	0.3	GC/MS	-	0.3	0.3
Bicycloheptadiene	GC/MS	0.3	0.3	0.8	GC/FID	-	5.1	1.1
Dicyclopentadiene	GC/MS	0.3	0.3	0.3	GC/FID	-	5.1	0.45
Methylcyclohexane*	GC/MS	0.3	0.3	0.3	GC/MS	-	0.3	0.3
Methylisobutyl ketone	GC/MS	0.3	0.5	0.4	GC/FID	-	5.2	0.64

- = Certification not received

* = Significant nontarget compound without a CRL. The lower limit of detection is 10% of the internal standard for the method used. For the purpose of this report, a CRL of 0.30 µg/g was used

** = Ortho- and para- (o- and p-) Xylenes coelute under the GC conditions specified in this method

Table ESA 2.3-1/ESA-1
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Table ESA 2.1-1 Phase I and II Analytes and Certified Reporting Limits for Eastern Study Area Soil Samples. Page 2 of 6.

Analytical Groups/Analytes	Phase I				Phase II			
	Method	CAL	ESE	MRI	Method	CAL	ESE	DataChem
Volatile Aromatic Organics (VAOs)								
Benzene	GC/MS	0.3	0.3	1	GC/PID	-	0.081	0.085
Ethylbenzene	GC/MS	0.3	0.3	0.4	GC/PID	-	0.043	0.16
m-Xylene	GC/MS	0.7	0.3	0.3	GC/PID	-	0.053	0.26
o- and p-Xylene**	GC/MS	0.3	0.5	0.5	GC/PID	-	0.086	0.39
Toluene	GC/MS	0.3	0.3	0.3	GC/PID	-	0.096	0.19
Organosulfur Compounds, Mustard-Agent Related (OSCMs)								
1,4-Oxathiane	GC/MS	6	0.3	0.5	GC/FPD	-	0.90	1.7
Chloroacetic acid	GC/MS	7	0.3	2	HPLC	-	18	36
Dithiane	GC/MS	-	-	-	GC/FPD	-	0.60	1.4
Thiodiglycol	GC/MS	-	-	-	HPLC	-	2.6	4.2
Organosulfur Compounds, Herbicide Related (OSCHs)								
Benzothiazole	GC/MS	4	0.3	0.3	GC/FPD	-	0.53	2.0
Chlorophenylmethyl sulfide	GC/MS	0.6	0.3	0.4	GC/FPD	-	1.1	4.4
Chlorophenylmethyl sulfone	GC/MS	7	0.4	1	GC/FPD	-	2.4	9.0
Chlorophenylmethyl sulfoxide	GC/MS	0.8	0.3	4	GC/FPD	-	2.3	4.8
Dimethyldisulfide	GC/MS	-	0.3	-	GC/FPD	-	0.70	3.1

- = Certification not received

* = Significant nontarget compound without a CRL. The lower limit of detection is 10% of the internal standard for the method used. For the purpose of this report, a CRL of 0.30 µg/g was used

** = Ortho- and para- (o- and p-) Xylenes coelute under the GC conditions specified in this method

Table ESA 2.1-1 Phase I and II Analytes and Certified Reporting Limits for Eastern Study Area Soil Samples. Page 3 of 6.

Analytical Groups/Analytes	Phase I				Phase II			
	Method	CAL	ESE	MRI	Method	CAL	ESE	DataChem
Organophosphorous Compounds, GB-Agent Related (OPHGBs)								
Diisopropylmethyl phosphonate	GC/MS	0.3	0.5	0.3	GC/FPD	0.050	0.11	-
Dimethylmethyl phosphonate	GC/MS	-	2	-	GC/FPD	0.050	0.13	-
Isopropylmethyl phosphonic acid	-	-	-	-	HPLC	4.7	2.6	-
Methylphosphonic acid	-	-	-	-	IONCHROM	-	2.0	-
Phosphoric acid, tributyl ester*	GC/MS	0.3	0.3	0.3	GC/MS	0.3	0.3	-
Phosphoric acid, triphenyl ester*	GC/MS	0.3	0.3	0.3	GC/MS	0.3	0.3	-
Organophosphorous Compounds, Pesticide Related (OPHPS)								
Atrazine	GC/MS	0.3	0.7	0.5	GC/NPD	-	0.25	-
Malathion	GC/MS	0.3	0.6	2	GC/NPD	-	0.25	-
Parathion	GC/MS	0.4	0.7	2	GC/NPD	-	0.25	-
Supona	GC/MS	0.3	0.5	0.9	GC/NPD	-	0.25	-
Vapona	GC/MS	0.3	0.3	0.3	GC/NPD	-	0.70	-
DBCP	GC/MS	0.3	0.3	0.6	GC/EC	0.014	0.0050	0.0050
Organonitrogen Compounds (ONCS)								
Caprolactum*	-	-	-	-	GC/MS	-	-	0.3
Hydrazine	-	-	-	-	IONCHROM	-	-	50
Methylhydrazine	-	-	-	-	IONCHROM	-	-	200
n-Nitrosodimethylamine	-	-	-	-	GC/NPD	-	-	0.26
n-Nitrosodi-n-propylamine	-	-	-	-	GC/NPD	-	-	0.10
Unsymmetrical dimethyl hydrazine	-	-	-	-	IONCHROM	-	-	200

- = Certification not received

* = Significant nontarget compound without a CTRL. The lower limit of detection is 10% of the internal standard for the method used. For the purpose of this report, a CTRL of 0.30 µg/g was used

** = Ortho- and para- (o- and p-) Xylenes coelute under the GC conditions specified in this method

Table ESA 2.1-1 Phase I and II Analytes and Certified Reporting Limits for Eastern Study Area Soil Samples. Page 4 of 6.

Analytical Groups/Analytes	Phase I				Phase II				
	Method	CAL	ESE	MRI	DataChem	Method	CAL	ESE	DataChem
Fluoroacetic Acid		-	-	-	-	IONCHROM	-	2.0	-
Polynuclear Aromatic Hydrocarbons (PAHs)									
Fluoranthene*	GC/MS	0.3	0.3	0.3	0.3	GC/MS	0.3	0.3	0.3
Methylnaphthalene*	GC/MS	0.3	0.3	0.3	0.3	GC/MS	0.3	0.3	0.3
Phenanthrene*	GC/MS	0.3	0.3	0.3	0.3	GC/MS	0.3	0.3	0.3
Pyrene*	GC/MS	0.3	0.3	0.3	0.3	GC/MS	0.3	0.3	0.3
Semivolatile Halogenated Organics (SHOs)									
Hexachlorobenzene*	GC/MS	0.3	0.3	0.3	0.3	GC/MS	0.3	0.3	0.3
Hexachlorobutadiene*	GC/MS	0.3	0.3	0.3	0.3	GC/MS	0.3	0.3	0.3
Hexachlorocyclopentadiene	GC/MS	0.3	1	1	0.6	GL/EC	-	0.0026	0.0018
Pentachlorobenzene*	GC/MS	0.3	0.3	0.3	0.3	GC/MS	0.3	0.3	0.3
Tetrachlorobenzene*	GC/MS	0.3	0.3	0.3	0.3	GC/MS	0.3	0.3	0.3
Trichlorobenzene*	GC/MS	0.3	0.3	0.3	0.3	GC/MS	0.3	0.3	0.3

- = Certification not received

* = Significant nontarget compound without a CRL. The lower limit of detection is 10% of the internal standard for the method used. For the purpose of this report, a CRL of 0.30 µg/g was used

** = Ortho- and para- (o- and p-) Xylenes coelute under the GC conditions specified in this method

Table ESA 2.3-1/ESA-1
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Table ESA 2.1-1 Phase I and II Analytes and Certified Reporting Limits for Eastern Study Area Soil Samples. Page 5 of 6.

Analytical Groups/Analytes	Phase I				Phase II				
	Method	CAL	ESE	MRI	DataChem	Method	CAL	ESE	DataChem
Organochlorine Pesticides (OCPs)									
Aldrin	GC/MS	0.3	0.9	0.5	0.3	GC/EC	-	0.0018	0.0019
Chlordane	GC/MS	0.6	1	6	2	GC/EC	-	0.11	0.023
Dichlorodiphenylethane (DDE)	GC/MS	0.3	0.3	0.5	0.6	GC/EC	-	0.0010	0.0024
Dichlorodiphenyltrichloroethane (DDT)	GC/MS	0.6	0.4	2	0.5	GC/EC	-	0.050	0.0020
Dieldrin	GC/MS	0.3	0.3	0.6	0.3	GC/EC	-	0.0012	0.0033
Endrin	GC/MS	0.3	0.7	4	0.5	GC/EC	-	0.0010	0.0058
Isodrin	GC/MS	0.3	0.3	0.6	0.3	GC/EC	-	0.0011	0.0011
Arsenic	GFAA	5.0	4.7	2.5	2.5	GFAA	5.0	4.7	2.5
Mercury	CVAA	0.060	0.050	0.070	0.050	CVAA	0.060	0.050	0.050
ICP Metals									
Cadmium	ICP	0.66	0.90	0.51	0.74	ICP	0.66	0.90	0.74
Chromium	ICP	5.2	7.2	7.4	6.5	ICP	5.2	7.2	6.5
Copper	ICP	4.9	4.8	4.9	4.7	ICP	4.9	4.8	4.7
Lead	ICP	13	17	16	8.4	ICP	13	17	8.4
Zinc	ICP	9.5	16	28	8.7	ICP	9.5	16	8.7

- = Certification not received

* = Significant nontarget compound without a CRL. The lower limit of detection is 10% of the internal standard for the method used. For the purpose of this report, a CRL* of 0.30 µg/g was used

** = Ortho- and para- (o- and p-) Xylenes coelute under the GC conditions specified in this method

Notes:

CAL = California Analytical Laboratory, W. Sacramento, California.
 ESE = Environmental Science and Engineering, Inc., Gainesville, Florida.
 MRI = Midwest Research Institute, Kansas City, Missouri.
 DataChem = formerly UBTL, Salt Lake City, Utah.

Method:

GC/MS = Gas chromatography/mass spectrometry.
 GC/FID = Gas chromatography/flame ionization detector.
 GC/HECD = Gas chromatography/hall electrolytic conductivity detector.
 GC/PID = Gas chromatography/photoionization detector.
 GC/FPD = Gas chromatography/flame photometric detector.
 GC/EC = Gas chromatography/electron capture.
 GC/NPD = Gas chromatography/nitrogen phosphorous detector.
 CVAA = Cold vapor atomic absorption.
 GFAA = Graphite furnace atomic absorption.
 ICP = Inductively coupled plasma.
 IONCHROM = Ion chromatography.
 HPLC = High performance liquid chromatography.

Source: EBASCO, April 1989.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 1 of 30.

ESA-1. Surface Burn Sites						
Analytical Groups and Analytes Detected	Phase I Analyses		Phase II Analyses			
	32	113	2		4	
	Frequency of Detections ¹	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections ¹	Range (µg/g)	CRL Range (µg/g) ²
<u>Volatiles Halogenated Organics (VHOS)</u>						
1,1-Dichloroethane	0/8	BCRL	0.3-0.5	ND	—	—
1,2-Dichloroethane	0/8	BCRL	0.3-0.4	ND	—	—
1,1-Dichloroethylene	ND	—	—	ND	—	—
1,2-Dichloroethylene	0/8	BCRL	0.3-0.6	ND	—	—
1,1,2,2-Tetrachloroethane*	ND	—	—	ND	—	—
1,1,1-Trichloroethane	0/8	BCRL	0.3-0.5	ND	—	—
1,1,2-Trichloroethane	0/8	BCRL	0.3-0.6	ND	—	—
Carbon Tetrachloride	0/8	BCRL	0.3-0.4	ND	—	—
Chlorobenzene	0/8	BCRL	0.3	ND	—	—
Chloroform	0/8	BCRL	0.3-0.7	ND	—	—
Tetrachloroethylene	0/8	BCRL	0.3-0.5	ND	—	—
Trichloroethylene	0/8	BCRL	0.3-0.6	ND	—	—
Trichloropropene*	ND	—	—	ND	—	—
Methylene Chloride	0/4	BCRL	0.3 /	ND	—	—
<u>Volatiles Hydrocarbons (VHCs)</u>						
2-Butoxyethanol*	ND	—	—	ND	—	—
4-Hydroxy-4-methyl-2-pentanone*	ND	—	—	ND	—	—
1-Methyl-1,3-cyclopentadiene*	ND	—	—	ND	—	—
2,2-Oxybisethanol*	13	0.5-1.0	—	ND	—	—
2-Pentanone*	ND	—	—	ND	—	—
Bicycloheptadiene	0/8	BCRL	0.5-0.8	ND	—	—

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Sampling Analytical Results in the Eastern Study Area. Page 2 of 30.

ESA-1. Surface Burn Sites						
Total Borings Total Samples	Phase I Analyses		Phase II Analyses			
	32	113	2		4	CRL Range (µg/g)/2
	Frequency of Detections/1	Range (µg/g)	Frequency of Detections/1	Range (µg/g)	Frequency of Detections/1	
Analytical Groups and Analytes Detected						
Dicyclopentadiene	0/113	BCRL		0.3-6	0/1	0.3
Methylcyclohexane*	ND	—		—	ND	—
Methylisobutyl Ketone	0/8	BCRL		0.4-0.5	ND	—
<u>Volatile Aromatic Organics (VAOs)</u>						
Benzene	0/8	BCRL		0.3-1	ND	—
Ethylbenzene	0/8	BCRL		0.3-0.4	ND	—
m-Xylene	0/8	BCRL		0.3	ND	—
o- and p-Xylene	1/9	0.7		0.5	ND	—
Toluene	0/8	BCRL		0.3	ND	—
<u>Organosulfur Compounds</u>						
Mustard - Agent Related (OSCMs)						
1,4-Oxathiane	0/113	BCRL		0.3-0.5	0/4	0.3-0.9
Chloroacetic acid	ND	—		—	ND	—
Dithiane	0/113	BCRL		0.3-2	0/4	0.3-0.6
Thiodiglycol	ND	—		—	ND	—
<u>Organosulfur Compounds</u>						
Herbicide Related (OSCHs)						
Benzothiazole	1	0.5		0.3	ND	—
Chlorophenylmethyl sulfide	0/113	BCRL		0.3	0/4	0.3-1
Chlorophenylmethyl sulfone	0/113	BCRL		0.3-0.4	0/4	0.4-2
Chlorophenylmethyl sulfoxide	0/113	BCRL		0.4-1	0/4	0.3-2
Dimethyldisulfide	0/8	BCRL		0.3-4	0/4	0.7

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 3 of 30.

ESA-1. Surface Burn Sites						
Analytical Groups and Analytes Detected	Phase I Analyses		Phase II Analyses			
	32	2	4			
	113		Frequency of Detections ¹	Range ($\mu\text{g/g}$) ²	Frequency of Detections ¹	Range ($\mu\text{g/g}$) ²
Organophosphorous Compounds/ GB-Agent Related (OPHGBs)						
Diisopropylmethyl phosphonate	0/113	BCRL	0/1	0.3	BCRL	0.3-0.11
Dimethylmethyl phosphonate	0/113	BCRL	0/1	2-3	BCRL	2
Isopropylmethyl phosphonic acid	ND	—	ND	—	—	—
Methylphosphonic acid	ND	—	ND	—	—	—
Phosphoric acid, tributyl ester*	ND	—	ND	—	—	—
Phosphoric acid, triphenyl ester*	ND	—	ND	—	—	—
Organophosphorous Compounds/ Pesticide Related (OP/HIPs)						
Atrazine	0/113	BCRL	0/1	0.5-0.7	BCRL	0.5
Malathion	0/113	BCRL	0/1	0.6-2	BCRL	0.6
Parathion	0/113	BCRL	0/1	0.7-2	BCRL	0.7
Supona	0/113	BCRL	0/1	0.5-0.9	BCRL	0.5
Vapona	0/113	BCRL	0/1	0.3	BCRL	0.3
Dibromochloropropane	0/113	BCRL	0/1	0.3-0.6	BCRL	0.3
Organonitrogen Compounds (ONCs)						
Hydrazine	ND	—	ND	—	—	—
Methylhydrazine	ND	—	ND	—	—	—
n-Nitrosodi-n-propylamine	ND	—	ND	—	—	—
n-Nitrosodimethylamine	ND	—	ND	—	—	—
Unsymmetrical dimethyl hydrazine	ND	—	ND	—	—	—

BCKL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

 $\mu\text{g/g}$ = Micrograms per gram.

ND = Analysis not requested for original target compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 4 of 30.

ESA-1. Surface Burn Sites						
Analytical Groups and Analytes Detected	Phase I Analyses		Phase II Analyses			
	32	113	2		4	
	Frequency of Detections ¹	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections ¹	Range (µg/g)	CRL Range (µg/g) ²
Fluoroacetic Acid	ND	—	—	ND	—	—
<u>Polynuclear Aromatic Hydrocarbons (PAHs)</u>						
Fluoranthene*	ND	—	—	ND	—	—
Methylanthrene*	5	0.5-1	0.3	ND	—	—
Phenanthrene*	2	1-20	0.3	ND	—	—
Pyrene*	ND	—	—	ND	—	—
<u>Semivolatile Halogenated Organics (SHOs)</u>						
Hexachlorobenzene*	ND	—	—	ND	—	—
Hexachlorobutadiene*	ND	—	—	ND	—	—
Hexachlorocyclopentadiene	0/113	BCRL	1	0/1	BCRL	1
Pentachlorobenzene*	ND	—	—	ND	—	—
Tetrachlorobenzene*	ND	—	—	ND	—	—
Trichlorobenzene*	ND	—	—	ND	—	—
<u>Organochlorine Pesticides (OCPs)</u>						
Aldrin	0/113	BCRL	0.5-0.9	0/1	BCRL	0.5
Chlordane	0/113	BCRL	1-6	0/1	BCRL	1
Dichlorodiphenylethane	0/113	BCRL	0.3-0.5	0/1	BCRL	0.3
Dichlorodiphenyltrichloroethane	0/113	BCRL	0.4-2	0/1	BCRL	0.4
Dieldrin	0/113	BCRL	0.3-0.6	0/1	BCRL	0.3
Endrin	0/113	BCRL	0.7-4	0/1	BCRL	0.7
Isodrin	0/113	BCRL	0.3-0.6	0/1	BCRL	0.3

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 5 of 30.

ESA-1. Surface Burn Sites						
Total Borings Total Samples	Phase I Analyses		Phase II Analyses			
	32	113	2	4		
Analytical Groups and Analytes Detected	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²
Arsenic (IR=CRL-10)	2/113	15-20	4.7-5.2	ND	—	—
Mercury (IR=CRL-0.10)	2/113	0.16-0.32	0.050-0.070	ND	—	—
ICP Metals						
Cadmium (IR=CRL-2.0)	11/113	2.1-5.1	0.51-0.90	ND	—	—
Chromium (IR=25-40)	5/113	44-56	7.2-7.4	ND	—	—
Copper (IR=20-35)	13/113	36-130	4.8-4.9	ND	—	—
Lead (IR=25-40)	14/113	41-110	16-17	ND	—	—
Zinc (IR=60-80)	18/113	81-120	16-28	ND	—	—

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 6 of 30.

ESA-2. Burlal Trench Sites						
Phase I Analyses		Phase II Analyses				
48		35				
126		105				
Analytical Groups and Analytes Detected	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²
<u>Volatile Halogenated Organics (VHOCs)</u>						
1,1-Dichloroethane	0/71	BCRL	0.3-2	0/37	BCRL	0.07-2
1,2-Dichloroethane	0/71	BCRL	0.3-0.6	0/37	BCRL	0.08-0.6
1,1-Dichloroethylene	ND	BCRL	0.3	0/20	BCRL	0.2
1,2-Dichloroethylene	0/32	BCRL	0.3-2	0/37	BCRL	0.3-2
1,1,2,2-Tetrachloroethane*	ND	--	--	ND	--	--
1,1,1-Trichloroethane	1/71	3	0.3-0.4	3/37	0.5-1	0.09-0.4
1,1,2-Trichloroethane	0/71	BCRL	0.3-0.6	0/37	BCRL	0.3-0.4
Carbon Tetrachloride	0/71	BCRL	0.03-0.4	0/37	BCRL	0.1-0.3
Chlorobenzene	0/71	BCRL	0.3-2	0/37	BCRL	0.2-2
Chloroform	1/71	0.4	0.3	0/37	BCRL	0.07-0.3
Tetrachloroethylene	1/71	0.4	0.3	0/37	BCRL	0.2-0.3
Trichloroethylene	0/71	BCRL	0.3-0.6	2/37	0.50-1	0.1-0.5
Trichloropropene*	ND	--	--	ND	--	--
Methylene Chloride	4/55	1	0.7-2	3/37	1	0.7-2
<u>Volatile Hydrocarbons (VHCS)</u>						
2-Butoxyethanol*	ND	--	--	ND	--	--
4-Hydroxy-4-methyl-2-pentanone*	ND	--	--	ND	--	--
1-Methyl-1,3-cyclopentadiene*	ND	--	--	ND	--	--
2,2-Oxybisethanol*	ND	--	--	ND	--	--
2-Pentanone*	ND	--	--	ND	--	--
Bicycloheptadiene	0/71	BCRL	0.3-0.8	0/18	BCRL	0.3-0.4

BCRL = Below Certified Reporting Limit.

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BU/L = At or Below Upper Indicator Level

µg/g = Micrograms per gram

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 7 of 30.

		ESA-2, Burlal Trench Sites			
		Phase I Analyses		Phase II Analyses	
		48	35	105	
Total Borings		126			
Total Samples					
Analytical Groups and Analytes Detected	Frequency of Detections ¹	Range (µg/g)	Range (µg/g) ²	Frequency of Detections ¹	Range (µg/g) ²
Dicyclopentadiene	0/125	BCRL	0.3-6	0/29	BCRL
Methylcyclohexane*	ND	---	---	ND	---
Methylisobutyl Ketone	0/71	BCRL	0.3-2	0/18	BCRL
<u>Volatiles Aromatic Organics (VAOs)</u>					
Benzene	4/71	0.3-0.5	0.3	5/40	0.014-0.5
Ethylbenzene	0/71	BCRL	0.3-0.4	0/40	BCRL
m-Xylene	1/71	0.8	0.7-0.8	0/40	BCRL
o- and p-Xylene	1/71	5	0.3-5	0/40	BCRL
Toluene	0/71	BCRL	0.3-0.6	0/40	BCRL
<u>Organosulfur Compounds</u>					
Mustard - Agent Related (OSCMs)					
1,4-Oxathiane	0/125	BCRL	0.3-6	0/20	BCRL
Chloroacetic acid	0/38	BCRL	40	0/22	BCRL
Dithiane	0/125	BCRL	0.3-7	0/20	BCRL
Thiodiglycol	0/38	BCRL	4	0/22	BCRL
<u>Organosulfur Compounds</u>					
Herbicide Related (OSCHs)					
Benzothiazole	ND	---	---	0/9	BCRL
Chlorophenylmethyl sulfide	0/125	BCRL	0.3-4	0/20	BCRL
Chlorophenylmethyl sulfone	2/125	0.9-2	0.3-0.6	0/20	BCRL
Chlorophenylmethyl sulfoxide	0/125	BCRL	0.3-0.6	0/20	BCRL
Dimethyldisulfide	0/71	BCRL	0.3-20	0/25	BCRL

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

• = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 8 of 30.

ESA-2, Burlal Trench Sites						
Phase I Analyses			Phase II Analyses			
48			35			
126			105			
Analytical Groups and Analytes Detected	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²
<u>Organophosphorus Compounds/GB-Agent Related (OPHGRs)</u>						
Diisopropylmethyl phosphonate	0/125	BCRL	0.3-3	0/12	BCRL	0.1-0.5
Dimethylmethyl phosphonate	0/39	BCRL	2-3	0/11	BCRL	0.1-2
Isopropylmethyl phosphonic acid	0/18	BCRL	0.6-5	0/22	BCRL	2
Methylphosphonic acid	ND	—	—	0/22	—	2-10
Phosphoric acid, tributyl ester*	ND	—	—	ND	—	—
Phosphoric acid, triphenyl ester*	ND	—	—	ND	—	—
<u>Organophosphorus Compounds/Pesticide Related (OPHPS)</u>						
Atrazine	0/126	BCRL	0.3-0.7	0/12	BCRL	0.3-0.7
Malathion	0/126	BCRL	0.3-2	0/12	BCRL	0.3-0.6
Parathion	0/126	BCRL	0.3-2	0/12	BCRL	0.4-0.6
Fipronil	0/126	BCRL	0.3-4	0/12	BCRL	0.3-0.5
Vapona	0/126	BCRL	0.3-3	0/12	BCRL	0.3
Dibromochloropropane	0/125	BCRL	0.3-2	0/29	BCRL	0.3-2
<u>Organonitrogen Compounds (ONCs)</u>						
Hydrazine	ND	—	—	ND	—	—
Methylhydrazine	ND	—	—	ND	—	—
n-Nitrosodi-n-propylamine	ND	—	—	ND	—	—
n-Nitrosodimethylamine	ND	—	—	ND	—	—
Unsymmetrical dimethyl hydrazine	ND	—	—	ND	—	—

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 9 of 30.

Total Borings Total Samples	ESA-2, Burlal Trench Sites					
	Phase I Analyses			Phase II Analyses		
	48	35	105	35	105	
Analytical Groups and Analytes Detected	Frequency of Detections ¹	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections ¹	Range (µg/g)	CRL Range (µg/g) ²
Fluoroacetic Acid	ND	--	--	1/22	19	2.0
Polynuclear Aromatic Hydrocarbons (PAHs)						
Fluoranthene*	ND	--	--	ND	--	--
Methylanthracene*	ND	--	--	ND	--	--
Phenanthrene*	ND	--	--	ND	--	--
Pyrene*	ND	--	--	ND	--	--
Semivolatile Halogenated Organics (SHOs)						
Hexachlorobenzene*	ND	--	--	ND	--	--
Hexachlorobutadiene*	ND	--	--	ND	--	--
Hexachlorocyclopentadiene	0/125	BCRL	0.3-1	0/22	BCRL	0.002-1
Pentachlorobenzene*	ND	--	--	ND	--	--
Tetrachlorobenzene*	ND	--	--	ND	--	--
Trichlorobenzene*	ND	--	--	ND	--	--
Organochlorine Pesticides (OCPs)						
Aldrin	1/125	2	0.3	1/22	0.5	0.002-0.9
Chlordane	0/125	BCRL	0.6-6	0/22	BCRL	0.02-0.2
Dichlorodiphenylethane	0/125	BCRL	0.3-0.6	0/22	BCRL	0.001-0.3
Dichlorodiphenyltrichloroethane	0/125	BCRL	0.4-2	0/22	BCRL	0.002-0.6
Dieldrin	1/125	20	0.3-0.6	1/22	0.003	0.001-0.3
Endrin	0/125	BCRL	0.3-4	0/22	BCRL	0.001-0.7
Isodrin	0/125	BCRL	0.3-0.6	0/22	BCRL	0.001-0.3

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BU/L = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

• = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 10 of 30.

ESA-2, Burtal Trench Sites						
Phase I Analyses			Phase II Analyses			
Total Borings Total Samples			48 126	35 105		
Analytical Groups and Analytes Detected	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²
Arsenic (IR=CRL-10)	2/125	14-32	2.5-5.2	0/16	BUIL	4.7
Mercury (IR=CRL-0.10)	3/125	0.15-0.81	0.050-0.06	0/9	BUIL	0.050
ICP Metals						
Cadmium (IR=CRL-2.0)	8/125	3.1-50	0.51-1.0	1/33	59	0.70
Chromium (IR=25-40)	0/125	BUIL	6.5-7.4	0/33	BUIL	6.0
Copper (IR=20-35)	23/125	36-340	2.0-4.7	1/33	200	4.7-4.9
Lead (IR=25-40)	8/125	43-3,400	5-16	1/33	46	8.0-13
Zinc (IR=60-80)	28/125	81-57,000	8.7-9.5	5/33	83-130	8.0

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

N/A = Analysis not requested for original target compounds/subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the inter standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 11 of 30.

ESA-3. Toxic Storage Sites						
Phase I Analyses			Phase II Analyses			
86			44			
289			127			
Total Borings			Total Samples			
Analytical Groups and Analytes Detected						
Frequency of Detections ¹	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections ¹	Range (µg/g)	CRL Range (µg/g) ²	
Volatile Halogenated Organics (VHOCs)						
0/19	BCRL	0.9-2	0/27	BCRL	0.9-2	
0/19	BCRL	0.3-0.6	0/27	BCRL	0.3-0.6	
ND	--	--	ND	--	--	
ND	--	--	0/22	BCRL	0.3-2	
ND	--	--	1	0.6	0.3	
0/19	BCRL	0.3-0.4	1/27	2	0.3-0.4	
0/19	BCRL	0.3-0.4	0/27	BCRL	0.3-0.4	
0/19	BCRL	0.3	0/27	BCRL	0.2-0.3	
0/19	BCRL	0.3-2	0/27	BCRL	0.3-2	
0/19	BCRL	0.3	0/27	BCRL	0.3	
1/19	0.3	0.3	0/27	BCRL	0.2-0.3	
0/19	BCRL	0.3-0.5	1/27	0.8	0.3-0.5	
ND	--	--	ND	--	--	
0/19	BCRL	0.7-2	0/27	BCRL	0.7-2.0	
Methylene Chloride						
Volatile Hydrocarbons (VHOCs)						
2	0.3	0.3	ND	--	--	
ND	--	--	ND	--	--	
ND	--	--	ND	--	--	
ND	--	--	ND	--	--	
ND	--	--	ND	--	--	
0/19	BCRL	0.3-0.4	0/27	BCRL	0.3-0.4	
Bicycloheptadiene						

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 12 of 30.

ESA-3. Toxic Storage Sites						
Phase I Analyses			Phase II Analyses			
86			44			
29			127			
Total Borings						
Total Samples						
Analytical Groups and Analytes Detected	Frequency of Detections ^{1/}	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections ^{1/}	Range (µg/g)	CRL Range (µg/g) ²
Dicyclopentadiene	0/143	BCRL	0.4-1	0/65	BCRL	1
Methylcyclohexane*	ND	—	—	ND	—	—
Methylisobutyl Ketone	0/19	BCRL	0.3-0.7	0/27	BCRL	0.3-0.7
<u>Volatile Aromatic Organics (VAOs)</u>						
Benzene	0/19	BCRL	0.3	0/27	BCRL	0.2-0.3
Ethylbenzene	0/19	BCRL	0.3-0.4	0/27	BCRL	0.3-0.4
m-Xylene	0/19	BCRL	0.7-0.8	0/27	BCRL	0.7
o- and p-Xylene	0/19	BCRL	0.3-5	0/27	BCRL	0.3-5
Toluene	3/19	0.9-1	0.3	0/27	BCRL	0.2-0.3
<u>Organosulfur Compounds</u>						
<u>Mustard - Agent Related (OSCMs)</u>						
1,4-Oxathiane	2/139	0.6-0.9	0.3-6	2/99	2.1-9.8	1.7
Chloroacetic acid	0/37	BCRL	40	3/99	120-130	36
Dithiane	5/139	1-90	0.3-7	4/99	14-330	1.5
Thiodiglycol	4/158	6-30	3-4	0/99	BCRL	4
<u>Organosulfur Compounds</u>						
<u>Herbicide Related (OSCHs)</u>						
Benzothiazole	ND	—	—	0/34	BCRL	2
Chlorophenylmethyl sulfide	0/139	BCRL	0.5-4	0/99	BCRL	0.9-4
Chlorophenylmethyl sulfone	0/139	BCRL	0.2-7	0/99	BCRL	0.3-5
Chlorophenylmethyl sulfoxide	0/139	BCRL	0.3-0.7	1/99	9.3	0.48
Dimethyldisulfide	0/19	BCRL	0.8-20	0/61	BCRL	0.8-20

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 13 of 30.

ESA-3. Toxic Storage Sites						
Analytical Groups and Analytes Detected	Phase I Analyses		Phase II Analyses			
	86	239	44	127	Range (µg/g)	CRL Range (µg/g) ²
Organophosphorous Compounds/ GB-Agent Related (OPHGBs)						
Diisopropylmethyl phosphonate	0/155	BCRL		0/69	BCRL	0.05-1
Dimethylmethyl phosphonate	0/20	BCRL		0/43	BCRL	0.05
Isopropylmethyl phosphonic acid	0/79	BCRL		1/43	47	4.7
Methylphosphonic acid	ND	—		ND	—	—
Phosphoric acid, tributyl ester*	ND	—		ND	—	—
Phosphoric acid, triphenyl ester*	ND	—		ND	—	—
Organophosphorous Compounds/ Pesticide Related (OPHPs)						
Atrazine	0/139	BCRL		0/65	BCRL	0.3
Malathion	0/139	BCRL		0/65	BCRL	0.7
Parathion	0/139	BCRL		0/65	BCRL	0.9
Supona	0/139	BCRL		0/65	BCRL	0.6
Vapona	0/139	BCRL		0/65	BCRL	3
Dibromochloropropane	0/143	BCRL		0/65	BCRL	0.3-2
Organonitrogen Compounds (ONCs)						
Hydrazine	ND	—		ND	—	—
Methylhydrazine	ND	—		ND	—	—
n-Nitrosodi-n-propylamine	ND	—		ND	—	—
n-Nitrosodimethylamine	ND	—		ND	—	—
Unsymmetrical dimethyl hydrazine	ND	—		ND	—	—

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

/1 = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/2 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 14 of 30.

		ESA-3. Toxic Site Sites			
Total Borings Total Samples		Phase I Analyses 86 239		Phase II Analyses 44 127	
Analytical Groups and Analytes Detected	Frequency of Detections ¹	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections ¹	Range (µg/g) CRL Range (µg/g) ²
Fluoroacetic Acid	ND	—	—	ND	—
Polynuclear Aromatic Hydrocarbons (PAHs)					
Fluoranthene*	ND	—	—	ND	—
Methylnaphthalene*	ND	—	—	ND	—
Phenanthrene*	ND	—	—	ND	—
Pyrene*	ND	—	—	ND	—
Semivolatile Halogenated Organics (SHOs)					
Hexachlorobenzene*	ND	—	—	ND	—
Hexachlorobutadiene*	ND	—	—	ND	—
Hexachlorocyclopentadiene	0/139	BCRL	0.3-0.6	0/65	BCRL
Pentachlorobenzene*	ND	—	—	ND	0.6
Tetrachlorobenzene*	ND	—	—	ND	—
Trichlorobenzene*	ND	—	—	ND	—
Organochlorine Pesticides (OCPs)					
Aldrin	0/139	BCRL	0.3-0.6	0/65	BCRL
Chlordane	0/139	BCRL	0.6-2	0/65	BCRL
Dichlorodiphenylethane	0/139	BCRL	0.3-0.9	0/65	BCRL
Dichlorodiphenyltrichloroethane	0/139	BCRL	0.3-0.6	0/65	BCRL
Dieldrin	0/139	BCRL	0.3-0.8	0/65	BCRL
Endrin	0/139	BCRL	0.3-0.6	0/65	BCRL
Isodrin	0/139	BCRL	0.3-0.5	0/65	BCRL

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUFL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for non-target compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 15 of 30.

ESA-3. Toxic Storage Sites						
Total Borings Total Samples	Phase I Analyses			Phase II Analyses		
	86	44	127	44	127	
Analytical Groups and Analytes Detected	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²
Arsenic (IR=CRL-10)	2/130	75-270	2.5-5	4/74	12-130	2.0
Mercury (IR=CRL-0,10)	0/130	BUIL	0.050-0.50	0/47	BUIL	0.050
ICP Metals						
Cadmium (IR=CRL-2.0)	1/130	4.3	0.66-0.74	2/75	3.1-3.6	0.70
Chromium (IR=25-40)	0/130	BUIL	5.2-6.5	1/75	41	6.0
Copper (IR=20-35)	0/130	BUIL	4.7-4.9	0/75	BUIL	4.7
Lead (IR=25-40)	4/130	42-140	8.4-13	2/75	45-53	8.0
Zinc (IR=60-80)	6/130	81-550	8.7-9.5	8/75	82-180	8.0

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 16 of 30.

ESA-4. Munitions Activity Sites						
Phase I Analyses			Phase II Analyses			
66			11			
170			29			
Total Borings						
Total Samples						
Analytical Groups and Analytes Detected	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²
<u>Volatile Halogenated Organics (VHOCs)</u>						
1,1-Dichloroethane	0/13	BCRL	0.3-0.5	0/6	BCRL	0.3
1,2-Dichloroethane	0/13	BCRL	0.3-0.4	0/6	BCRL	0.3
1,1-Dichloroethylene	ND	---	---	ND	---	---
1,2-Dichloroethylene	0/13	BCRL	0.3-0.8	0/6	BCRL	0.3
1,1,2,2-Tetrachloroethane*	1	4	0.3	ND	---	---
1,1,1-Trichloroethane	0/13	BCRL	0.3-0.5	0/6	BCRL	0.3
1,1,2-Trichloroethane	0/13	BCRL	0.3-0.6	0/6	BCRL	0.3
Carbon Tetrachloride	0/13	BCRL	0.3-0.4	0/6	BCRL	0.3
Chlorobenzene	0/13	BCRL	0.3	0/6	BCRL	0.3
Chloroform	0/13	BCRL	0.3-0.7	0/6	BCRL	0.3
Tetrachloroethylene	0/13	BCRL	0.3-0.5	0/6	BCRL	0.3
Trichloroethylene	0/13	BCRL	0.3-0.6	0/6	BCRL	0.3
Trichloropropene*	ND	---	---	ND	---	---
Methylene Chloride	0/6	BCRL	0.3	0/6	BCRL	0.3
<u>Volatile Hydrocarbons (VHOCs)</u>						
2-Butoxyethanol*	ND	---	---	ND	---	---
4-Hydroxy-4-methyl-2-pentanone*	ND	---	---	ND	---	---
1-Methyl-1,3-cyclopentadiene*	ND	---	---	ND	---	---
2,2-Oxybisethanol*	3	0.5-0.9	0.3	ND	---	---
2-Pentanone*	ND	---	---	ND	---	---
Bicycloheptadiene	0/13	BCRL	0.3-0.8	0/6	BCRL	0.3

BCRL = Below Certified Reporting Limit.

IL = Indicator Level.

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 17 of 30

ESA-4. Munitions Activity Sites						
Phase I Analytes		Phase II Analytes				
66		11				
170		29				
Total Borings		CRL				
Total Samples		Range				
Analytical Groups and Analytes Detected		Frequency of Detections ¹	Range (µg/g)	Frequency of Detections ¹	Range (µg/g)	CRL Range (µg/g) ²
Dicyclopentadiene		0/161	BCRL	0/23	BCRL	0.3
Methylcyclohexane*		ND	--	ND	--	--
Methylisobutyl Ketone		0/13	BCRL	0/6	BCRL	0.5
<u>Volatile Aromatic Organics (VAOs)</u>						
Benzene		0/13	BCRL	0/6	BCRL	0.3
Ethylbenzene		0/13	BCRL	0/6	BCRL	0.3
m-Xylene		0/13	BCRL	0/6	BCRL	0.3
o- and p-Xylene		0/13	BCRL	0/6	BCRL	0.5
Toluene		0/13	BCRL	0/6	BCRL	0.3
<u>Organosulfur Compounds</u>						
<u>Mustard - Agent Related (OSCMs)</u>						
1,4-Oxathiane		0/159	BCRL	0/23	BCRL	0.3
Chloroacetic acid		ND	--	0/14	BCRL	20
Dithiane		0/159	BCRL	0/23	BCRL	0.3
Thiodiglycol		ND	--	0/14	BCRL	3
<u>Organosulfur Compounds</u>						
<u>Herbicide Related (OSCHs)</u>						
Benzothiazole		ND	--	ND	--	--
Chlorophenylmethyl sulfide		0/159	BCRL	0/23	BCRL	0.3
Chlorophenylmethyl sulfone		0/159	BCRL	0/23	BCRL	0.4
Chlorophenylmethyl sulfoxide		0/159	BCRL	0/23	BCRL	0.3
Dimethyldisulfide		0/13	BCRL	0/6	BCRL	0.3

BCRL = Below Certified Reporting Limit.

IL = Indicator Level.

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 18 of 30.

ESA-4. Munitions Activity Sites						
Phase I Analyses			Phase II Analyses			
Total Borings Total Samples			11 29			
66 170						
Analytical Groups and Analytes Detected	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g)/2	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g)/2
Organophosphorous Compounds/ GB-Agent Related (OPHGBs)						
Diisopropylmethyl phosphonate	0/159	BCRL	0.5-3	0/23	BCRL	0.5
Dimethylmethyl phosphonate	0/159	BCRL	2-3	0/23	BCRL	2
Isopropylmethyl phosphonic acid	ND	—	—	0/14	BCRL	2
Methylphosphonic acid	ND	—	—	0/14	BCRL	2
Phosphoric acid, tributyl ester*	ND	—	—	ND	—	—
Phosphoric acid, triphenyl ester*	ND	—	—	ND	—	—
Organophosphorous Compounds/ Pesticide Related (OPHPS)						
Atrazine	0/159	BCRL	0.5-0.7	0/23	BCRL	0.7
Malathion	0/159	BCRL	0.6-2	0/23	BCRL	0.6
Parathion	0/159	BCRL	0.7-2	0/23	BCRL	0.6
Supona	0/159	BCRL	0.5-0.9	0/23	BCRL	0.5
Vapona	0/159	BCRL	0.3	0/23	BCRL	0.3
Dibromochloropropane	0/161	BCRL	0.3-0.9	0/23	BCRL	0.3
Organonitrogen Compounds (ONCS)						
Hydrazine	ND	—	—	ND	—	—
Methylhydrazine	ND	—	—	ND	—	—
n-Nitrosodi-n-propylamine	ND	—	—	ND	—	—
n-Nitrosodimethylamine	ND	—	—	ND	—	—
Unsymmetrical dimethyl hydrazine	ND	—	—	ND	—	—

BCRL = Below Certified Reporting Limit.

IL = Indicator Level.

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for non-target compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 19 of 30.

ESA-4. Munitions Activity Sites						
Analytical Groups and Analytes Detected	Phase I Analyses		Phase II Analyses			
	66	170	11		29	
	Frequency of Detections ^{1/}	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections ^{1/}	Range (µg/g)	CRL Range (µg/g) ²
Fluoroacetic Acid	ND	—	—	2/14	3.9-8.9	2.0
Polynuclear Aromatic Hydrocarbons (PAHs)						
Fluoranthene*	ND	—	—	ND	—	—
Methylnaphthalene*	ND	—	—	ND	—	—
Phenanthrene*	ND	—	—	ND	—	—
Pyrene*	ND	—	—	ND	—	—
Semivolatile Halogenated Organics (SHOs)						
Hexachlorobenzene*	ND	—	—	ND	—	—
Hexachlorobutadiene*	ND	—	—	ND	—	—
Hexachlorocyclopentadiene	0/159	BCRL	1	0/23	BCRL	1
Pentachlorobenzene*	ND	—	—	ND	—	—
Tetrachlorobenzene*	ND	—	—	ND	—	—
Trichlorobenzene*	ND	—	—	ND	—	—
Organochlorine Pesticides (OCPs)						
Aldrin	0/159	BCRL	0.5-0.9	0/23	BCRL	0.9
Chlordane	0/159	BCRL	1-6	0/23	BCRL	2
Dichlorodiphenylethane	0/159	BCRL	0.3-0.5	0/23	BCRL	0.3
Dichlorodiphenyltrichloroethane	0/159	BCRL	0.4-2	0/23	BCRL	0.4
Dieldrin	0/159	BCRL	0.3-0.6	0/23	BCRL	0.3
Endrin	0/159	BCRL	0.7-4	0/23	BCRL	0.7
Isodrin	0/159	BCRL	0.3-0.6	0/23	BCRL	0.3

BCRL = Below Certified Reporting Limit.

IL = Indicator Level.

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 20 of 30.

ESA-4. Munitions Activity Sites						
Total Borings Total Samples	Phase I Analyses		Phase II Analyses			
	66	170	11	29		
Analytical Groups and Analytes Detected	Frequency of Detections/1	Range (µg/g)	CPL Range (µg/g)/2	Frequency of Detections/1	Range (µg/g)	CPL Range (µg/g)/2
Arsenic (IR=CRL-10)	2/166	11	4.7-5.2	0/17	BUIL	4.7
Mercury (IR=CRL-0,10)	4/166	0.11-0.14	0.050-0.070	0/23	BUIL	0.050
ICP Metals						
Cadmium (IR=CRL-2,0)	0/166	BUIL	0.50-0.90	0/17	BUIL	0.92
Chromium (IR=25-40)	0/170	BUIL	7.2-7.4	0/17	BUIL	7.2
Copper (IR=20-35)	15/170	36-500	4.8-4.9	6/17	37	5.0
Lead (IR=25-40)	4/170	41-200	16-17	2/17	41	17
Zinc (IR=60-80)	18/170	82-160	16-28	4/17	81	8.0

BCRL = Below Certified Reporting Limit

IL = Indicator Level

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

• = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2: Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 21 of 30.

Analytical Groups and Analytes Detected	ESA-5: Demilitarization Activity Site			
	Phase I Analyses		Phase II Analyses	
	6	7	14	
Total Borings	18			
Total Samples				
Analytical Groups and Analytes Detected	Frequency of Detections /1	Range (µg/g)	CRL Range (µg/g) ²	CRL Range (µg/g) ²
<u>Volatiles/Halogenated Organics (VHOCs)</u>				
1,1-Dichloroethane	0/1	BCRL	0.5	—
1,2-Dichloroethane	0/1	BCRL	0.4	—
1,1-Dichloroethylene	ND	—	—	—
1,2-Dichloroethylene	0/1	BCRL	0.8	—
1,1,2,2-Tetrachloroethane*	ND	—	—	—
1,1,1-Trichloroethane	0/1	BCRL	0.5	—
1,1,2-Trichloroethane	0/1	BCRL	0.6	—
Carbon Tetrachloride	0/1	BCRL	0.4	—
Chlorobenzene	0/1	BCRL	0.3	—
Chloroform	0/1	BCRL	0.7	—
Tetrachloroethylene	0/1	BCRL	0.5	—
Trichloroethylene	0/1	BCRL	0.6	—
Trichloropropene*	ND	—	—	—
Methylene Chloride	ND	—	—	—
<u>Volatiles/Hydrocarbons (VHOCs)</u>				
2-Butoxyethanol*	ND	—	—	—
4-Hydroxy-4-methyl-2-pentanone*	ND	—	—	—
1-Methyl-1,3-cyclopentadiene*	ND	—	—	—
2,2-Oxybisethanol*	ND	—	—	—
2-Pentanone*	ND	—	—	—
Bicycloheptadiene	0/1	BCRL	0.8	—

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Not Detected

/1 = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/2 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

* = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

• = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 22 of 30.

ESA-5. Demilitarization Activity Site						
Phase I Analyses			Phase II Analyses			
6			7			
18			14			
Total Borings						
Total Samples						
Analytical Groups and Analytes Detected	Frequency of Detections ¹	Range ($\mu\text{g/g}$)	CRL Range ($\mu\text{g/g}$) ²	Frequency of Detections ¹	Range ($\mu\text{g/g}$)	CRL Range ($\mu\text{g/g}$) ²
Dicyclopentadiene	0/18	BCRL	6	0/14	BCRL	0.3
Methylcyclohexane*	ND	—	—	ND	—	—
Methylisobutyl Ketone	0/1	BCRL	0.4	ND	—	—
<u>Volatile Aromatic Organics (VAOs)</u>						
Benzene	0/1	BCRL	1	ND	—	—
Ethylbenzene	0/1	BCRL	0.4	ND	—	—
m-Xylene	0/1	BCRL	0.3	ND	—	—
o- and p-Xylene	0/1	BCRL	0.5	ND	—	—
Toluene	0/1	BCRL	0.3	ND	—	—
<u>Organosulfur Compounds</u>						
Mustard-Agent Related (OSCMs)						
1,4-Oxathiane	0/18	BCRL	0.5	0/14	BCRL	0.3
Chloroacetic acid	ND	—	—	ND	—	—
Dithiane	0/18	BCRL	2	0/14	BCRL	0.3
Thiodiglycol	ND	—	—	ND	—	—
<u>Organosulfur Compounds</u>						
Herbicide-Related (OSCHs)						
Benzothiazole	ND	—	—	ND	—	—
Chlorophenylmethyl sulfide	0/18	BCRL	0.3	0/14	BCRL	0.3
Chlorophenylmethyl sulfone	0/18	BCRL	1	0/14	BCRL	0.4
Chlorophenylmethyl sulfoxide	0/18	BCRL	0.4	0/14	BCRL	0.3
Dimethyldisulfide	0/1	BCRL	4	ND	—	—

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

 $\mu\text{g/g}$ = Micrograms per gram.

ND = Analysis not requested for original target compounds/subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 23 of 30.

		ESA-5. Demilitarization Activity Site				
		Phase I Analyses		Phase II Analyses		
Total Borings		6		7		
Total Samples		18		14		
Analytical Groups and Analytes Detected	Frequency of Detections ¹	Range ($\mu\text{g/g}$)	CRL Range ($\mu\text{g/g}$) ²	Frequency of Detections ¹	Range ($\mu\text{g/g}$)	CRL Range ($\mu\text{g/g}$) ²
<u>Organophosphorous Compounds/</u>						
<u>GB-Agent Related (OPHGBs)</u>						
Diisopropylmethyl phosphonate	0/18	BCRL	3	0/14	BCRL	0.5
Dimethylmethyl phosphonate	0/18	BCRL	3	0/14	BCRL	2
Isopropylmethyl phosphonic acid	ND	—	—	0/14	BCRL	2
Methylphosphonic acid	ND	—	—	0/14	BCRL	2-20
Phosphoric acid, tributyl ester*	ND	—	—	ND	—	—
Phosphoric acid, triphenyl ester*	ND	—	—	ND	—	—
<u>Organophosphorous Compounds/</u>						
<u>Pesticide Related (OPHPS)</u>						
Atrazine	0/18	BCRL	0.5	0/14	BCRL	0.7
Malathion	0/18	BCRL	2	0/14	BCRL	0.6
Parathion	0/18	BCRL	2	0/14	BCRL	0.6
Supona	0/18	BCRL	0.9	0/14	BCRL	0.5
Vapona	0/18	BCRL	0.3	0/14	BCRL	0.3
Dibromochloropropane	0/18	BCRL	0.6	0/14	BCRL	0.3
<u>Organonitrogen Compounds (ONCs)</u>						
Hydrazine	ND	—	—	ND	—	—
Methylhydrazine	ND	—	—	ND	—	—
n-Nitrosodi-n-propylamine	ND	—	—	ND	—	—
n-Nitrosodimethylamine	ND	—	—	ND	—	—
Unsymmetrical dimethyl hydrazine	ND	—	—	ND	—	—

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

 $\mu\text{g/g}$ = Micrograms per gram.

ND = Analysis not requested for original target compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 24 of 30.

ESA-5. Demilitarization Activity Site						
Analytical Groups and Analytes Detected	Phase I Analyses		Phase II Analyses			
	6	7	7	14	7	14
	18	18	18	18	18	18
Total Borings						
Total Samples						
Analytical Groups and Analytes Detected	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²
Fluoroacetic Acid	ND	—	—	1/14	7.1	2.0
Polynuclear Aromatic Hydrocarbons (PAHs)						
Fluoranthene*	ND	—	—	ND	—	—
Methylnaphthalene*	ND	—	—	ND	—	—
Phenanthrene*	ND	—	—	ND	—	—
Pyrene*	ND	—	—	ND	—	—
Semivolatile Halogenated Organics (SHOs)						
Hexachlorobenzene*	ND	—	—	ND	—	—
Hexachlorobutadiene*	ND	—	—	ND	—	—
Hexachlorocyclopentadiene	0/18	BCRL	1	0/14	BCRL	1
Pentachlorobenzene*	ND	—	—	ND	—	—
Tetrachlorobenzene*	ND	—	—	ND	—	—
Trichlorobenzene*	ND	—	—	ND	—	—
Organochlorine Pesticides (OCPs)						
Aldrin	0/18	BCRL	0.5	0/14	BCRL	0.9
Chlordane	0/18	BCRL	6	0/14	BCRL	2
Dichlorodiphenylethane	0/18	BCRL	0.5	0/14	BCRL	0.3
Dichlorodiphenyltrichloroethane	0/18	BCRL	2	0/14	BCRL	0.4
Dieldrin	0/18	BCRL	0.6	0/14	BCRL	0.3
Endrin	0/18	BCRL	4	0/14	BCRL	0.7
Isodrin	0/13	BCRL	0.6	0/14	BCRL	0.3

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 25 of 30.

ESA-5. Demilitarization Activity Site						
Analytical Groups and Analytes Detected	Phase I Analyses		Phase II Analyses			
	6		7			
	18		14			
	Frequency of Detections ¹	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections ¹	Range (µg/g)	CRL Range (µg/g) ²
<u>Arsenic (IR=CRL-10)</u>	0/18	BUIL	5.2	ND	—	—
<u>Mercury (IR=CRL-0.10)</u>	0/18	BUIL	0.050-0.070	ND	—	—
<u>ICP Metals</u>						
Cadmium (IR=CRL-2.0)	0/18	BUIL	0.51	ND	—	—
Chromium (IR=25-40)	0/18	BUIL	7.2-7.4	ND	—	—
Copper (IR=20-35)	7/18	38-54	4.7	ND	—	—
Lead (IR=25-40)	0/18	BUIL	17	ND	—	—
Zinc (IR=60-80)	6/18	82-110	28	ND	—	—

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 26 of 30.

Total Borings Total Samples	Balance of Investigations					
	Phase I Analyses			Phase II Analyses		
	32 113			21 51		
Analytical Groups and Analytes Detected						
Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²	
<u>Volatile Halogenated Organics (VHOCs)</u>						
0/7	BCRL	0.3-0.9	0/5	BCRL	2	
0/7	BCRL	0.3-0.4	0/5	BCRL	0.6	
ND	—	—	ND	—	—	
0/6	BCRL	0.3-0.8	0/5	BCRL	2	
ND	—	—	ND	—	—	
0/7	—	—	0/5	BCRL	0.4	
0/7	BCRL	0.3-0.6	0/5	BCRL	0.4	
0/7	BCRL	0.3-0.4	0/5	BCRL	0.2	
0/7	BCRL	0.3	0/5	BCRL	2	
0/7	BCRL	0.3-0.7	0/5	BCRL	0.3	
0/7	BCRL	0.3-0.5	0/5	BCRL	0.2	
0/7	BCRL	0.3-0.6	0/5	BCRL	0.5	
1	0.6	0.3	ND	—	—	
0/5	BCRL	0.3-0.7	0/5	BCRL	2	
<u>Methylene Chloride</u>						
<u>Volatile Hydrocarbons (VHCs)</u>						
ND	—	—	ND	—	—	
ND	—	—	ND	—	—	
ND	—	—	ND	—	—	
15/15	0.4-4	—	ND	—	—	
ND	—	—	ND	—	—	
0/7	BCRL	0.3-0.8	0/5	BCRL	0.4	
<u>Bicycloheptadiene</u>						

BCRL = Below Certified Reporting Limit.

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUJL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 27 of 30.

		Balance of Investigations				
		Phase I Analyses		Phase II Analyses		
Total Borings		32		21		
Total Samples		113		51		
Analytical Groups and Analytes Detected	Frequency of Detections /1	Range (µg/g)	CRL Range (µg/g)/2	Frequency of Detections /1	Range (µg/g)	CRL Range (µg/g)/2
Dicyclopentadiene	0/417	BCRL	0.3-6	0/15	BCRL	0.3-1
Methylcyclohexane*	ND	—	—	ND	—	—
Methylisobutyl Ketone	0/7	BCRL	0.3-0.5	0/5	BCRL	0.7
<u>Volatile Aromatic Organics (VAOs)</u>						
Benzene	0/7	BCRL	0.3-1	0/5	BCRL	0.2
Ethylbenzene	0/7	BCRL	0.3-0.4	0/5	BCRL	0.4
m-Xylene	0/7	BCRL	0.3-0.7	0/5	BCRL	0.7
o- and p-Xylene	0/7	BCRL	0.3-0.5	0/5	BCRL	5
Toluene	1/8	0.5	0.3	0/5	BCRL	0.2
<u>Organosulfur Compounds</u>						
Mustard - Agent Related (OSCMs)						
1,4-Oxathiane	0/417	BCRL	0.3-6	0/15	BCRL	0.3
Chloroacetic acid	ND	—	—	0/1	BCRL	40
Dithiane	0/417	BCRL	0.3-7	0/15	BCRL	0.3-0.4
Thiodiglycol	0/16	BCRL	3	0/1	BCRL	4
<u>Organosulfur Compounds</u>						
Herbicide Related (OSCHs)						
Benzothiazole	ND	—	—	ND	—	—
Chlorophenylmethyl sulfide	0/417	BCRL	0.3-4	0/15	BCRL	0.3-0.9
Chlorophenylmethyl sulfone	0/417	BCRL	0.3-7	0/15	BCRL	0.3-0.4
Chlorophenylmethyl sulfoxide	0/417	BCRL	0.3-0.6	0/15	BCRL	0.3
Dimethyldisulfide	0/7	BCRL	0.3-4	0/5	BCRL	20

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 28 of 30.

Balance of Investigations						
Analytical Groups and Analytes Detected	Phase I Analyses		Phase II Analyses			
	32	21	51			
	113		Frequency of Detections ¹	Range (µg/g)	Frequency of Detections ¹	CRL Range (µg/g) ²
<u>Organophosphorous Compounds/GB-Agent Related (OPHGBs)</u>						
Diisopropylmethyl phosphonate	0/417	BCRL	0/15	0.3-3	BCRL	0.5-1
Dimethylmethyl phosphonate	0/234	BCRL	0/4	2-3	BCRL	0.05-2
Isopropylmethyl phosphonic acid	ND	—	0/5	—	BCRL	5
Methylphosphonic acid	ND	—	ND	—	—	—
Phosphoric acid, tributyl ester*	ND	—	ND	—	—	—
Phosphoric acid, triphenyl ester*	ND	—	ND	—	—	—
<u>Organophosphorous Compounds/Pesticide Related (OPHPs)</u>						
Atrazine	0/417	BCRL	0/15	0.3-0.7	BCRL	0.3-0.7
Malathion	0/417	BCRL	0/15	0.3-2	BCRL	0.6-0.7
Parathion	0/417	BCRL	0/15	0.4-2	BCRL	0.6-0.9
Supona	0/417	BCRL	0/15	0.3-0.9	BCRL	0.5-0.6
Vapona	0/417	BCRL	0/15	0.3-3	BCRL	0.3
Dibromochloropropane	0/419	BCRL	0/15	0.005-0.6	BCRL	0.3-2
<u>Organonitrogen Compounds (ONCs)</u>						
Hydrazine	ND	—	ND	—	—	—
Methylhydrazine	ND	—	ND	—	—	—
n-Nitrosodi-n-propylamine	ND	—	ND	—	—	—
n-Nitrosodimethylamine	ND	—	ND	—	—	—
Unsymmetrical dimethyl hydrazine	ND	—	ND	—	—	—

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 29 of 30.

Total Borings Total Samples	Balance of Investigations					
	Phase I Analyses			Phase II Analyses		
	32	113	21	51	21	51
Analytical Groups and Analytes Detected	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections/1	Range (µg/g)	CRL Range (µg/g) ²
Fluoroacetic Acid	ND	--	--	1/4	2.7	2.0
Polynuclear Aromatic Hydrocarbons (PAHs)						
Fluoranthene*	ND	--	--	ND	--	--
Methylnaphthalene*	ND	--	--	ND	--	--
Phenanthrene*	ND	--	--	ND	--	--
Pyrene*	ND	--	--	ND	--	--
Semivolatile Halogenated Organics (SHOs)						
Hexachlorobenzene*	1	0.5	0.3	ND	--	--
Hexachlorobutadiene*	ND	--	--	ND	--	--
Hexachlorocyclopentadiene	0/417	BCRL	0.3-1	0/15	BCRL	0.6-1
Pentachlorobenzene*	ND	--	--	ND	--	--
Tetrachlorobenzene*	ND	--	--	ND	--	--
Trichlorobenzene*	ND	--	--	ND	--	--
Organochlorine Pesticides (OCPs)						
Aldrin	0/417	BCRL	0.3-0.9	0/15	BCRL	0.3-0.9
Chlordane	0/417	BCRL	0.6-6	0/15	2CRL	2
Dichlorodiphenylethane	0/417	BCRL	0.3-0.6	0/15	BCRL	0.3-0.6
Dichlorodiphenyltrichloroethane	0/417	BCRL	0.4-2	0/15	BCRL	0.4-0.5
Dieldrin	0/417	BCRL	0.3-0.6	0/15	BCRL	0.3
Endrin	0/417	BCRL	0.3-4	0/15	BCRL	0.5-0.7
Isodrin	0/417	BCRL	0.3-0.6	0/15	BCRL	0.3

BCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND = Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

/1 = Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used.

/2 = Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

* = There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

Table ESA 2.1-2. Summary of Soil Boring Analytical Results in the Eastern Study Area. Page 30 of 30.

Total Borings Total Samples	Balance of Investigations					
	Phase I Analyses			Phase II Analyses		
	22	113		21	51	
Analytical Groups and Analytes Detected	Frequency of Detections ^{1/}	Range (µg/g)	CRL Range (µg/g) ²	Frequency of Detections ^{1/}	Range (µg/g)	CRL Range (µg/g) ²
Arsenic (IR=CRL-10)	5/470	11-21	2.5-5.2	2/21	25	2.0-4.7
Mercury (IR=CRL-0.10)	5/464	0.12-0.45	0.050-0.070	1/23	BUIL	0.050
ICP Metals						
Cadmium (IR=2.0)	1/435	6.6	0.51-0.92	0/37	BUIL	0.70-0.92
Chromium (IR=40)	3/470	46-62	5.2-12	0/37	BUIL	6.0-7.2
Copper (IR=35)	7/470	40-120	4.7-4.9	1/37	99	4.8-5.0
Lead (IR=40)	3/470	41-60	8.4-17	1/37	180	8.0-17
Zinc (IR=80)	14/470	81-180	8.7-28	7/37	88-120	16

HCRL = Below Certified Reporting Limit.

IR = Indicator Range

BUIL = At or Below Upper Indicator Level

µg/g = Micrograms per gram.

ND

/1

= Analysis not requested for original target compounds/not detected for nontarget compounds subsequently considered in analyte groups.

= Fraction represents the total number of detections of an analyte in relation to the number of analyses conducted in a distinct sample. This value does not include multiple detections of a specific analyte in the same sample which occasionally has occurred when more than one analytical method has been used.

/2 = (Certified Reporting Limit (CRL), or detection limits used among laboratories conducting analyses for specific sites shown on table. Variability also may reflect dilution effect for some sample analyses.

= There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not

Table ESA 2.2-1. List of Chemical Analyses Conducted on Task 4 Water Samples. Page 1 of 3.

Analysis/Analytes	Level of Certification	Analytical Method	Certified Reporting Limit (µg/l)
Volatile Halogenated Organics			
1,1 - Dichloroethane	Quantitative	PACK-GC/Hall	1.2
1,2 - Dichloroethane			0.61
1,1 - Dichloroethylene			1.1
1,2 - Dichloroethylene			2.4
1,1,1 - Trichloroethane			1.7
1,1,2 - Trichloroethane			1.0
Carbon tetrachloride			1.4
Chlorobenzene			0.58
Chloroform			
Methylene chloride			5.0
Tetrachloroethylene			1.1
Trichloroethylene			1.2
Volatile Hydrocarbons			
Dicyclopentadiene	Quantitative	CAP-GC/FID	9.3
Methylisobutyl ketone			13
Volatile Aromatics			
Benzene	Quantitative	PACK-GC/PID	1.3
Ethylbenzene			1.0
Toluene			1.2
Xylene (m-)			1.4
Xylene (o-, p-)			2.5
Organosulfur Compounds Mustard-Agent Related			
Dithiane	Quantitative	PACK-GC/FPD-S	
1,4 - Oxathiane			
	1.1		2.0

Table ESA 2.2-1. List of Chemical Analyses Conducted on Task 4 Water Samples. Page 2 of 3.

Analysis/Analytes	Level of Certification	Analytical Method	Certified Reporting Limit (µg/l)
Organosulfur Compounds			
Insecticide Related			
Dimethylsulfide	Quantitative	PACK-GC/FPD-S	1.8
Chlorophenylmethyl sulfide (CPMS)			4.2
Chlorophenylmethyl sulfone (CPMSO ₂)			4.7
Chlorophenylmethyl sulfoxide (CPMSO)			1.3
Organophosphorus Compounds			
IR-Agent Related	Quantitative	PACK-GC/FPD-P	
Diisopropylmethyl phosphonate			10
Dimethylmethyl phosphonate			15
DBCP			
Di-bromochloropropane	Quantitative	CAP-GC/ECD	0.13
Organochlorine Pesticides			
Alkin	Quantitative	CAP-GC/ECD	
DDE			0.070
DDT			0.050
Dieldrin			0.070
Endrin			0.060
Hexachlorocyclopentadiene			0.050
Isalrin			0.070
			0.060
Arsenic	Quantitative	AA-hydride furnace	3.9
Mercury	Quantitative	Cold vapor atomic absorption	0.20

Table ESA 2.2-1. List of Chemical Analyses Conducted on Task 4 Water Samples. Page 3 of 3.

Analysis/Analytes	Level of Certification	Analytical Method	Certified Reporting Limit (µg/l)
ICP Metals			
Cadmium	Quantitative	Inductively coupled plasma	5.2
Chromium			6.0
Copper			7.9
Lead			19
Zinc			20
Other Analytes			
Calcium	Quantitative	Inductively coupled plasma ion chromatography ion chromatography Inductively coupled plasma ion chromatography AA flame Inductively coupled plasma Auto analyzer	4,800
Chloride			1,200
Fluoride			500
Magnesium			10
Nitrate/Nitrite			1,300
Potassium			760
Sodium			10,000
Sulfate			

Table ESA 2.2-2. List of Chemical Analyses Conducted on Task 44 Water Samples. Page 1 of 3.

Analysis/Analytes	Certification Level	Method	Certified Reporting Limit ($\mu\text{g/l}$)
<u>Organochlorine Pesticides</u>	Quantitative	CAP-GC/ECD	
Aldrin			0.083
Endrin			0.060
Dieldrin			0.055
Isodrin			0.056
Hexachlorocyclopentadiene			0.083
DDE			0.046
DDT			0.059
Chlordane			0.15
<u>Volatile Organohalogens</u>	Quantitative	PACK-GC/Hall	
Chlorobenzene			1.8
Chloroform			1.7
Carbon Tetrachloride			4.9
1,2 - Dichloroethylene			1.8
Trichloroethylene			1.3
Tetrachloroethylene			2.8
1,1 - Dichloroethylene			1.9
1,1 - Dichloroethane			1.9
1,2 - Dichloroethane			2.1
1,1,1 - Trichloroethane			1.1
1,1,2 - Trichloroethane			1.6
Methylene chloride			2.5
<u>Organosulfur Compounds</u>	Quantitative	PACK-GC/FPD-S	
Chlorophenylmethyl sulfone (CPMSO ₂)			2.2
Chlorophenylmethyl sulfoxide (CPMSO)			2.0
Chlorophenylmethyl sulfide (CPMS)			1.1
Dithiane			1.6
1,4-Oxathiane			1.4
Dimethyldisulfide			1.2
Benzothiazole			1.1
<u>Volatile Aromatics</u>	Quantitative	PACK-GC/TID	
Benzene			1.9
Ethylbenzene			0.62
Toluene			2.1
m-Xylene			1.0
o-, p-Xylene			1.3

Table ESA 2.2-2. List of Chemical Analyses Conducted on Task 44 Water Samples. Page 2 of 3.

Analysis/Analytes	Certification Level	Method	Certified Reporting Limit ($\mu\text{g/l}$)
DCPD/MIBK	Quantitative	CAP-GC/FID	
Dicyclopentadiene			9.3
Methylisobutyl ketone			13
DIMP/DMMP	Quantitative	PACK-GC/FPD-P	
Diisopropylmethyl phosphonate			10
Dimethylmethyl phosphonate			19
DBCP	Quantitative	CAP-GC/ECD	
Dibromochloropropane			0.13
Inorganics	Quantitative	Inductively Coupled Plasma	
Calcium			500
Magnesium			500
Sodium			760
Potassium			1,300
Cadmium			5.2
Chromium			6.0
Copper			7.9
Lead			19
Zinc			20
Arsenic		AA-Hydride	2.5
Mercury		EPA 245 Cold Vapor	0.36
Chloride		Ion Chromatograph	1,600
Fluoride			1,000
Sulfate			5,000
Nitrate & Nitrite		Auto Analyzer	10

Table ESA 2.2-2. List of Chemical Analyses Conducted on Task 44 Water Samples. Page 3 of 3.

Analysis/Analytes	Certification Level	Method	Certified Reporting Limit (µg/l)
Purgeables	Semiquantitative	GC/MS	
Ethylbenzene			2
Benzene			3
Methylisobutylketone			1
Dimethyldisulfide			4
1,1-Dichloroethane			1
1,2-Dichloroethane			0.7
1,1,1-Trichloroethane			2
1,1,2-Trichloroethane			2
Methylene chloride			2
Chloroform			2
Carbon Tetrachloride			5
1,2-Dichloroethylene			3
Toluene			4
Chlorobenzene			2
Tetrachloroethylene			3
Trichloroethylene			2
m-Xylene			3
o- and/or p-Xylene			2
Dibromochloropropane			6
Dicyclopentadiene			4
Bicycloheptadiene			2
Extractables	Semiquantitative	GC/MS	
Aldrin			5
Atrazine			6
Chlordane			5
Chlorophenylmethyl sulfone			8
Chlorophenylmethyl sulfoxide			20
Chlorophenylmethyl sulfide			10
Dibromochloropropane			20
Dicyclopentadiene			5
DDE			5
DDT			10
Dieldrin			5
Diisomethylphosphonate			6
Dithiane			10
Endrin			8
Hexachlorocyclopentadiene			10
Isodrin			6
Malathion			8
Oxathiane			6
Parathion			10
Supona			7
Vapona			9

Table ESA 2.2-3 Summary of Target and Significant Nontarget Compounds Detected in Eastern Study Area Surface Water Page 1 of 2.

Compound Group	Sampling Location	Compound Detected	Frequency of Detections	Concentration Range (µg/l)	Date of Detection
Volatile Halogenated Organics					
05-001	08ADD*	—	0/4	BCRL	—
08-001	13DCC*	—	0/10	BCRL	—
24-002	—	—	0/6	BCRL	—
24-007	—	—	0/1	BCRL	—
30-002	—	—	0/5	BCRL	—
31-001	Chlorobenzene	Chlorobenzene	1/4	1.8	6/30/86
31-002	Chloroform	Chloroform	1/4	3.5	07/01/86
Organophosphorous Compounds, GB-Agent Related					
05-001	08ADD*	—	0/4	BCRL	—
08-001	13DCC*	DIMP	1/10	11	12/20/85
24-002	—	DIMP	1/6	17	12/20/85
24-007	—	—	0/1	BCRL	—
30-002	—	—	0/5	BCRL	—
31-001	—	—	0/4	BCRL	—
31-002	—	—	0/4	BCRL	—
Organochlorine Pesticides					
05-001	08ADD*	—	0/4	BCRL	—
08-001	08ADD*	Aldrin	1/10	0.20	12/20/85
24-002	—	Dieldrin	1/10	Σ=0.26**	11/22/85
24-007	—	—	0/1	BCRL	—
30-002	—	—	0/5	BCRL	—
31-001	Aldrin	Aldrin	1/4	0.080	12/12/85
31-002	—	—	0/4	BCRL	—
24-002	13DCC*	Aldrin	1/6	0.20	12/20/85
24-007	13DCC*	Dieldrin	1/6	0.080	11/22/85
				Σ=0.28**	

BCRL = Below certified reporting limit

DIMP = Diisopropylmethyl phosphonate

* = Alternate name for sampling locations

** = Summation of the group.

Table ESA 2.2-3 Summary of Target and Significant Nontarget Compounds Detected in Eastern Study Area Surface Water Page 2 of 2.

Compound Group	Sampling Location	Compound Detected	Frequency of Detections	Concentration Range (µg/l)	Date of Detection
Arsenic					
05-001	08-001	Arsenic	1/2	3.8	05/15/87
08-001	08ADD*	Arsenic	1/7	6.6	04/02/86
24-002	13DCC*	Arsenic	1/2	3.5	06/17/87
24-007		Arsenic	1/1	5.0	05/15/87
30-002		—	0/2	BCRL	—
31-001		—	0/2	BCRL	—
31-002		Arsenic	1/2	7.3	05/27/87
LCP Metals					
05-001	08-001	—	0/2	BCRL	—
08-001	08ADD*	Zinc	2/7	24, 25	04/02/86, 12/16/86
08-001	08ADD*	Cadmium	1/7	14	03/26/87
08-001	08ADD*	Copper	1/7	21	03/26/87
08-001	08ADD*	Chromium	1/7	13	10/16/87
08-001	08ADD*	Lead	1/7	22	10/16/87
24-002	13DCC*	Zinc	2/4	41, 30	06/17/87, 04/02/86
24-007		—	0/1	BCRL	—
30-002		—	0/2	BCRL	—
31-001		Copper	1/2	10	10/22/87
31-002		—	0/2	BCRL	—

BCRL = Below certified reporting limit
DIMP = Diisopropylmethyl phosphonate
* = Alternate name for sampling locations.
** = Summation of the group.

Table ESA 2.3-1 Summary of Target and Significant Nontarget Compound Detections in Eastern Study Area Groundwater. Page 1 of 5.

Analytical Groups/Analytes	Total Wells Total Samples	Frequency of Detections	Alluvial		Frequency of Detections	Denver	
			19	52		37	95
			Concentration Range (µg/l)	CRL Range (µg/l)		Concentration Range (µg/l)	CRL Range (µg/l)
Volatile Halogenated Organics (VHOCs)							
1,1-Dichloroethane	0/45		BCRL	1.2 - 1.9	0/94	BCRL	0.73 - 1.9
1,2-Dichloroethane	1/45		0.64	0.61 - 2.1	0/94	BCRL	0.61 - 2.1
1,1-Dichloroethylene	0/43		BCRL	1.1 - 1.9	0/87	BCRL	1.1 - 1.7
1,2-Dichloroethylene	0/45		BCRL	1.2 - 1.8	0/94	BCRL	0.76 - 1.8
1,1,2,2-Tetrachloroethane*	ND		—	—	ND	—	—
1,1,1-Trichloroethane	0/45		BCRL	1.1 - 1.7	0/94	BCRL	0.76 - 3.0
1,1,2-Trichloroethane	0/45		BCRL	1.0 - 5.0	0/93	BCRL	0.78 - 5.0
Carbon tetrachloride	0/45		BCRL	1.7 - 2.4	0/94	BCRL	1.0 - 2.4
Chlorobenzene	3/45		0.74 - 1.9	0.58 - 1.4	6/94	4.8 - 45	0.58 - 1.4
Chloroform	4/45		0.58 - 60	0.50 - 1.9	1/94	20	1.4 - 1.9
Methylene chloride	0/41		BCRL	2.5 - 5.0	1/88	4.3	2.5 - 7.4
Tetrachloroethylene	0/45		BCRL	1.3 - 2.8	0/94	BCRL	0.75 - 2.8
Trichloroethylene	0/45		BCRL	1.1 - 5.5	1/94	2.4	0.56 - 5.5
Trichloropropene*	ND		—	—	ND	—	—
Volatile Hydrocarbons (VHCs)							
2-Butoxyethanol*	ND		—	—	ND	—	—
4-Hydroxy-4-methyl-2-pentanone*	ND		—	—	ND	—	—
1-Methyl-1,3-cyclopentadiene*	ND		—	—	ND	—	—
2,2'-Oxybisethanol*	ND		—	—	ND	—	—
2-Pentanone*	ND		—	—	ND	—	—
Bicycloheptadiene	ND		—	—	ND	—	—
Dicyclopentadiene	0/46		BCRL	9.3	0/94	BCRL	9.3 - 22
Methylcyclohexane*	ND		—	—	ND	—	—
Methylisobutyl ketone	0/46		BCRL	13 - 13	0/94	BCRL	4.9 - 13

* = Significant nontarget compound
BCRL = Below Certified Reporting Limit
ND = None Detected

Table ESA 2.3-1/ESA-1
5/19/89

Table ESA 2.3-1 Summary of Target and Significant Nontarget Compound Detections in Eastern Study Area Groundwater. Page 2 of 5.

Analytical Groups/Analytes	Total Wells Total Samples	Frequency of Detections	Alluvial		Frequency of Detections	Concentration Range (µg/l)	CRL Range (µg/l)	Denver	
			19	52				37	95
<u>Volatile Aromatic Organics (VAOs)</u>									
Benzene		1/41	2.4		12/91	1.3 - 1.9		1.4 - 20	1.3 - 1.9
Ethylbenzene		0/41	BCRL		0/91	0.62 - 1.3		BCRL	0.62 - 1.3
m-Xylene		0/41	BCRL		0/91	1.0 - 1.4		BCRL	1.0 - 2.0
o- and p-Xylene		0/41	BCRL		0/91	1.3 - 2.5		BCRL	1.3 - 3.2
Toluene		1/41	8.6		0/91	1.2 - 2.1		BCRL	1.2 - 2.8
<u>Organosulfur Compounds, Mustard-Agent Related (OSCMs)</u>									
1,4-Oxathiane		0/46	BCRL		0/92	1.4 - 2.0		BCRL	1.4 - 14
Chloroacetic acid		ND	—		ND	—		—	—
Dithiane		0/46	BCRL		0/92	1.6 - 3.3		BCRL	1.1 - 16
Thiodiglycol		ND	—		ND	—		—	—
<u>Organosulfur Compounds, Herbicide Related (OSCHs)</u>									
Benzothiazole		0/19	BCRL		0/28	1.1		BCRL	1.1
Chlorophenylmethyl sulfide		0/46	BCRL		0/92	1.0 - 1.3		BCRL	1.0 - 10
Chlorophenylmethyl sulfone		7/46	3.0 - 4.3		0/92	2.2 - 4.7		BCRL	2.2 - 26
Chlorophenylmethyl sulfoxide		1/46	6.1		0/92	2.0 - 4.2		BCRL	2.0 - 37
Dimethyldisulfide		0/46	BCRL		0/92	1.2 - 1.8		BCRL	1.2 - 17

* = Significant nontarget compound
 BCRL = Below Certified Reporting Limit
 ND = None Detected

Table ESA 2.3-1 Summary of Target and Significant Nontarget Compound Detections in Eastern Study Area Groundwater. Page 3 of 5.

Analytical Groups/Analytes	Total Wells Total Samples	Frequency of Detections	Alluvial		CRL Range (µg/l)	Frequency of Detections	Denver		CRL Range (µg/l)
			Concentration Range (µg/l)	Concentration Range (µg/l)					
Organophosphorous Compounds, GB-Agent Related (OPHGBs)									
Diisopropylmethyl phosphonate	0/46		BCRL		10 - 11	0/91	BCRL		10 - 11
Dimethylmethyl phosphonate	0/46		BCRL		15 - 30	0/91	BCRL		15 - 30
Isopropylmethyl phosphonic acid	ND		—		—	ND	—		—
Methylphosphonic acid	ND		—		—	ND	—		—
Phosphoric acid, tributyl ester*	ND		—		—	ND	—		—
Phosphoric acid, triphenyl ester*	ND		—		—	ND	—		—
Organophosphorous Compounds, Pesticide Related (OPHPS)									
Atrazine	ND		—		—	ND	—		—
Malathion	ND		—		—	ND	—		—
Parathion	ND		—		—	ND	—		—
Supona	ND		—		—	ND	—		—
Vapona	ND		—		—	ND	—		—
DBCP	1/46		0.16		0.13	2/95	0.15 - 0.75		0.13 - 0.20
Organonitrogen Compounds (ONCs)									
Caprolactum*	ND		—		—	ND	—		—
Hydrazine	ND		—		—	ND	—		—
Methylhydrazine	ND		—		—	ND	—		—
n-Nitrosodimethylamine	ND		—		—	ND	—		—
n-Nitrosodi-n-propylamine	ND		—		—	ND	—		—
Unsymmetrical dimethyl hydrazine	ND		—		—	ND	—		—

* = Significant nontarget compound
 BCRL = Below Certified Reporting Limit
 ND = None Detected

Table ESA 2.3-1 Summary of Target and Significant Nontarget Compound Detections in Eastern Study Area Groundwater. Page 4 of 5.

Analytical Groups/Analytes	Total Wells Total Samples	Frequency of Detections	Alluvial		Frequency of Detections	Denver		CRL Range (µg/l)
			Concentration Range (µg/l)	CRL Range (µg/l)		Concentration Range (µg/l)	CRL Range (µg/l)	
Fluoroacetic Acid		ND	—	—	ND	—	—	—
Polynuclear Aromatic Hydrocarbons (PAHs)								
Fluoranthene*		ND	—	—	ND	—	—	—
Methylnaphthalene*		ND	—	—	ND	—	—	—
Phenanthrene*		ND	—	—	ND	—	—	—
Pyrene*		ND	—	—	ND	—	—	—
Semi-Volatile Halogenated Organics (SHOs)								
Hexachlorobenzene*		ND	—	—	ND	—	—	—
Hexachlorobutadiene*		ND	—	—	ND	—	—	—
Hexachlorocyclopentadiene		0/42	BCRL	0.070 – 0.21	0/71	BCRL	0.070 – 0.15	—
Pentachlorobenzene*		ND	—	—	ND	—	—	—
Tetrachlorobenzene*		ND	—	—	ND	—	—	—
Trichlorobenzene*		ND	—	—	ND	—	—	—

* = Significant nontarget compound
 BCRL = Below Certified Reporting Limit
 ND = None Detected

Table ESA 2.3-1 Summary of Target and Significant Nontarget Compound Detections in Eastern Study Area Groundwater. Page 5 of 5.

Analytical Groups/Analytes	Total Wells Total Samples	Frequency of Detections	Alluvial		Frequency of Detections	Denver	
			Concentration Range (µg/l)	CRL Range (µg/l)		Concentration Range (µg/l)	CRL Range (µg/l)
Organochlorine Pesticides (OCPs)							
Aldrin	2/48		0.11	0.050 - 0.083	3/94	0.16 - 0.46	0.051 - 0.088
Chlordane	0/22		BCRL	0.15 - 0.23	0/33	BCRL	0.15 - 0.23
Dichlorodiphenylethane (DDE)	0/48		BCRL	0.046 - 0.16	0/94	BCRL	0.046 - 0.14
Dichlorodiphenyltrichloroethane (DDT)	0/48		BCRL	0.059 - 0.070	0/94	BCRL	0.050 - 0.13
Dieldrin	7/48		0.060 - 0.27	0.050 - 0.060	8/94	0.65 - 8.9	0.054 - 0.11
Endrin	2/48		0.074 - 0.18	0.050 - 0.063	3/94	0.090 - 0.20	0.050 - 0.32
Isodrin	0/48		BCRL	0.056 - 0.072	0/94	BCRL	0.056 - 0.14
Arsenic	3/26		4.7 - 5.3	2.5 - 3.9	10/46	2.6 - 26	2.5 - 4.0
Mercury	0/10		BCRL	0.36	0/22	BCRL	0.10 - 0.36
ICP Metals							
Cadmium	1/10		12	5.2	0/25	BCRL	5.2 - 8.4
Chromium	7/10		7.3 - 37	6.0	4/25	13 - 43	6.0 - 24
Copper	1/10		30	7.9	3/25	9.7 - 33	7.9
Lead	1/10		24	19	1/25	65	19 - 74
Zinc	7/10		41 - 140	20	16/25	22 - 300	20 - 22

* = Significant nontarget compound
 BCRL = Below Certified Reporting Limit
 ND = None Detected

Table ESA 2.3-2: Analytes Detected in Eastern Study Area Alluvial Well Samples (units in µg/l). Page 1 of 3.

Well ID	10/85 - 3/86 ISP	4/86 - 6/86 SP86	7/86 - 9/86 SUR6	10/86 - 12/86 FA86	1/87 - 3/87 W187	4/87 - 6/87 SP87	7/87 - 9/87 SUR7	1/89 - 3/89 W189
06002	•	C ₆ H ₆ 2.4	•			+ ClC ₆ H ₅ 1.4 Zn 41		
06003	•	•	•			+ Cr 7.3 Zn 110		
07001	•	•	•			+ Cd 12 ClC ₆ H ₅ 1.9 Cr 37 Cu 30 Pb 24 Zn 97		
08002	•							
08003	ENDRN 0.070	•				+ 12DCLE 0.64 ClC ₆ H ₅ 0.74 Cr 11		
19001						+ Cr 18		
24107			As 5.3			+ Cr 26 Zn 93		
24166			DLDRN 0.060	DLDRN 0.16	DLDRN 0.10	DLDRN 0.12	DLDRN 0.080	
24183			•	CPMSO 6.1 CPMSO ₂ 3.2	CPMSO ₂ 3.0 DBCP 0.16	CPMSO ₂ 3.7	As 4.7 CPMSO ₂ 3.6 DLDRN 0.087	
24188			•	CPMSO ₂ 4.3 MEC ₆ H ₅ 8.6	CHCl ₃ 22 CPMSO ₂ 4.0	CPMSO ₂ 3.4	As 5.1	
25011	•	•	•			+ Cr 12		
25038	•					+ Zn 53		

Table ESA 2.3-2. Analytes Detected in Eastern Study Area Alluvial Well Samples (units in µg/l). Page 2 of 3.

Well ID	10/85 - 3/86 ISP	4/86 - 6/86 SP86	7/86 - 9/86 SU86	10/86 - 12/86 FA86	1/87 - 3/87 WI87	4/87 - 6/87 SP87	7/87 - 9/87 SU87	1/89 - 3/89 WI89
30009	•	•	CHCl ₃ 60			+ Cr 16 Zn 140		
31005	•					+ Cr 23 Zn 43		
32001	ALDRN 0.11	•						
131014								CHCl ₃ 0.58
131015								•
131016								CHCl ₃ 0.37
32004								ALDRN 0.11 DLDRN 0.27 ENDRN 0.18

Table ESA 2.3.2: Analytes Detected in Eastern Study Area Alluvial Well Samples (units in µg/l). Page 3 of 3.

Notes:

SP Spring
SU Summer
FA Fall
WI Winter

Sample analyzed, all analytes below CRL.
ICP metals included in analytical suite
Initial Screening Program.

⁶ Hf6	Benzene.	As	Arsenic.
10C ₆ H ₅	Chlorobenzene.	Cr	Chromium.
2DCLE	1,2 - Dichloroethane.	Cd	Cadmium.
DBCP	Dibromochloropropane.	Cu	Copper.
TCLE	Trichloroethylene.	Pb	Lead.
H ₂ Cl ₂	Methylene chloride.	Zn	Zinc.
PMISO	Chlorophenyl sulfoxide.	ALDRN	Aldrin.
PMISO ₂	Chlorophenylmethyl sulfone.	DLDN	Dieldrin.
4EC ₆ H ₅	Toluene.	ENDRN	Endrin.
HCl ₃	Chloroform.		

Table ESA 2.3-3. Analytes Detected in Eastern Study Area Denver Well Samples (units in µg/l). Page 1 of 4.

Well ID	10/85 - 3/86 ISP	4/86 - 6/86 SP86	7/86 - 9/86 SU86	10/86 - 12/86 FA86	1/87 - 3/87 WI87	4/87 - 6/87 SP87	7/87 - 9/87 SU87
05001	•					+ Cr 16 Cu 9.7 Zn 74	
05002	•						
05003	•						
06004	•	•	•			+ As 2.6	
06005	C ₆ H ₆ 10 DBCP 0.75	•	•			+ •	
07004	•	•	C ₆ H ₆ 8.9			+ •	
07005	•	C ₆ H ₆ 3.0	C ₆ H ₆ 4.2				
08004	+ As 5.9 Zn 36						
08005	+ •					+ As 2.6 Zn 42	
19003						+ Cr 43 DLDRN 8.9 ENDRN 0.20 Zn 60	
19015	+ As 6.8 C ₆ H ₆ 7.3 Zn 43	•	•			+ Cr 13 Cu 17	
19016	+ As 26 C ₆ H ₆ 1.4 Zn 33	•	•				
19017	•					+ Cr 13 Zn 300	

Table ESA 2.3-3. Analytes Detected in Eastern Study Area Denver Well Samples (units in µg/l). Page 2 of 4.

Well ID	10/85 - 3/86 ISP	4/86 - 6/86 SP86	7/86 - 9/86 SUR6	10/86 - 12/86 FA86	1/87 - 3/87 WI87	4/87 - 6/87 SP87	7/87 - 9/87 SU87
19018	•						
19019	DLDRN 0.06 ENDRN 0.09	•					
24108			•	•	•	•	•
24109			As 8.6	•	•	•	•
24120			DLDRN 0.14	DLDRN 0.19	DLDRN 0.12	+ DLDRN 0.12 Zn 35	DLDRN 0.16
24174			C ₆ H ₆ 20 ClC ₆ H ₅ 45 DBCP 0.15 TRCLE 2.4	•	As 3.3	ClC ₆ H ₅ 10	As 3.9 C ₆ H ₆ 2.5 ClC ₆ H ₅ 14
24175			C ₆ H ₆ 4.5 ClC ₆ H ₅ 25	CH ₂ Cl ₂ 4.3	•	As 4.1 ClC ₆ H ₅ 17	ClC ₆ H ₅ 4.8 C ₆ H ₆ 4.0
25012	•						
25013	ALDRN 0.17	+Zn 82	+Zn 69			+ Zn 22	
25014	ALDRN 0.46 DLDRN 0.42	•	•			+ •	
25019	+ Zn 23					+ Zn 23	
25040	+ C ₆ H ₆ 2.1 Zn 34						
29002	•						
29003	•						

Table ESA 2.3-3. Analytes Detected in Eastern Study Area Denver Well Samples (units in µg/l). Page 3 of 4.

Well ID	10/85 - 3/86 ISP	4/86 - 6/86 SP86	7/86 - 9/86 SU86	10/86 - 12/86 FA86	1/87 - 3/87 W187	4/87 - 6/87 SP87	7/87 - 9/87 SU87
30004	•						
30005	ENDRN 0.12	•					
30010	•	•	•				
30011	•	•	CHCL ₃ 20		••		
31002		+ Cu 33					
31006	ALDRN 0.15	•	•				
31007	•	•	•				
31008	•	•	•				
32002	C6H6 1.8 + As 20 Zn 25					+ Pb 65 Zn 34	
32003	••						

See Notes on Next Page.

Table ESA 2.3-3. Summary of Analytes Detected in Eastern Study Area Denver Wells (units in µg/l). Page 4 of 4.

Notes:	
SP	Spring
SU	Summer
FA	Fall
WI	Winter
•	Sample analyzed, all analytes below CRL.
+	ICP Metals included in analytical suite
ISP	Initial Screening Program.
C ₆ H ₆	Benzene.
C ₁₀ H ₈	Chlorobenzene.
1,2-DCE	1,2 - Dichloroethane.
DBCP	Dibromochloropropane.
TRCLE	Trichloroethylene.
CH ₂ Cl ₂	Methylene chloride.
CPMSO	Chlorophenylmethyl sulfoxide.
CPMSO ₂	Chlorophenylmethyl sulfone.
MEC ₆ H ₅	Toluene.
CHCl ₃	Chloroform.
As	Arsenic.
Cr	Chromium.
Cd	Cadmium.
Cu	Copper.
Pb	Lead.
Zn	Zinc.
ALDRN	Aldrin.
DLDRN	Dieldrin.
ENDRN	Endrin.

Table ESA 2.4-1 Contaminant Classification of Structures in the Eastern Study Area. Page 1 of 2

CONTAMINATION CLASSIFICATION*	STRUCTURE NUMBER	SECTION	STRUCTURE FUNCTION
1	1736	31	Toxic Storage Yard
1	NN3103	31	Storage Building
1	NN3106	31	Shed
1	NN3109	31	Shed
2	395	6	Toxic Storage Yard Sewage Plant
2	785	6	Drum Storage Warehouse
2	792	31	Drum Storage Warehouse
2	853	30	Observation Pit/Mortar Range
2	864	6	General Structure
2	865	6	Warehouse
2	867A	6	Toxic Yard Metal & Wood Shop
2	867B	6	Flammable Materials Storehouse
2	871A	6	Magazine
2	871B	6	Magazine
2	871C	6	Magazine
2	871D	6	Magazine
2	872A	6	Magazine
2	872B	6	Magazine
2	872C	6	Magazine
2	872D	6	Magazine
2	873A	6	Magazine
2	873B	6	Magazine
2	873C	6	Magazine
2	874A	6	Magazine
2	874B	6	Magazine
2	874C	6	Magazine
2	874D	6	Magazine
2	883	6	Igloo Storage
2	1735	31	Loading Dock
2	NN0601	6	Loading Dock
2	NN0602	6	Long Metal Shed
2	NN0603	6	Metal Shed
2	NN2001	20	Antenna Installation

Table ESA 2.4-1 Contaminant Classification of Structures in the Eastern Study Area. Page 2 of 2

CONTAMINATION CLASSIFICATION*	STRUCTURE NUMBER	SECTION	STRUCTURE FUNCTION
2	NN3001	30	Metal Shed
2	NN3002	30	Metal Shed
2	NN3102	31	3 Sets Shed Siding
2	NN3104	31	Shack
2	NN3105	31	Shed
2	NN3107	31	Antenna Station
2	NN3108	31	Shed
3	786	6	Drum Storage Warehouse
3	787	6	Drum Storage Warehouse
3	788	6	Drum Storage Warehouse
3	791	31	Drum Storage Warehouse
3	793	31	Drum Storage Warehouse
3	794	31	Drum Storage Warehouse
3	795	31	Drum Storage Warehouse
3	796	31	Drum Storage Warehouse
3	797	31	Drum Storage Warehouse
3	798	31	Drum Storage Warehouse
3	851	19	Pistol Range House
3	866	6	Toxic Yard Office and Change House
3	881	6	Igloo Storage
3	882	6	Igloo Storage
3	884	6	Igloo Storage
3	885	6	Igloo Storage
3	886	6	Igloo Storage
3	1730	31	Sentry Station/Gatehouse
3	1734	31	Change House
3	NN9501	5	Abandoned Schoolhouse
3	NN2002	20	Tank Pad
3	NN3101	31	Metal Shed

- * 1 = Suspected to be contaminated
- 2 = Suspected to be contaminated but cleanable
- 3 = Suspected to be uncontaminated

Table ESA 2.5-1. Airborne Contaminant Distribution. Page 1 of 1.

<u>Parameter</u>	<u>Station AO4</u>
Total Suspended Particulates	
Number of Sampling Events	3
Annual Geometric Average ($\mu\text{g}/\text{m}^3$)	43
Range of Individual 24-Hour Samples ($\mu\text{g}/\text{m}^3$)	39-47

Source: ESE, 1988 (Air Media Rpt)

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Table ESA 2.6-1. Contaminants of Concern to Biota in Analyte Groups. Page 1 of 1.

GROUP	CONTAMINANT
1. <u>Volatile Halogenated Organics (VHOs)</u>	Chloroform Chlorobenzene Trichloroethylene Allyl chloride*
2. <u>Volatile Aromatic Organics (VAOs)</u>	Ethylbenzene Toluene Xylene
3. <u>Volatile Hydrocarbons (VHCs)</u>	Dicyclopentadiene (DCPD)
4. <u>Organochlorine Pesticides (OCPs)</u>	Aldrin Chlordane Dichlorodiphenylethane (DDE) Dichlorodiphenyltrichloroethane (DDT) Dieldrin Endrin Heptachlor* Heptachlor epoxide (HE)* Isodrin Oxychlordane* Polychlorinated Biphenyls (PCB)*,**
5. <u>Organophosphorous Compounds, Pesticide Related (OPHPs)</u>	Atrazine Azodrin* Malathion Methyl parathion* Parathion
6. <u>Organophosphorous Compounds, GB-Agent Related (OPHGBs)</u>	Diisopropylmethyl phosphonate (DIMP) Dimethylmethyl phosphonate (DMMP) Methylphosphonic acid (MPA)
7. <u>Organosulfur Compounds, Herbicide Related (OSCHs)</u>	Chlorophenylmethyl sulfide Chlorophenylmethyl sulfone Chlorophenylmethyl sulfoxide
8. <u>Organosulfur Compounds, Mustard-Agent Related (OSCMs)</u>	Dithiane Mustard* 1,4-Oxathiane
9. <u>Organonitrogen Compounds (ONCs)</u>	n-Nitosodimethylamine
10. <u>DBCP</u>	
11. <u>Arsenic</u>	
12. <u>Mercury</u>	
13. <u>ICP Metals (ICPs)</u>	Cadmium Copper

* Compounds not included in the contaminant groups of other media.

** Non-pesticide organochlorine

Table ESA 2.6-2. Certified Reporting Limits for Biota Analysis Methods. Page 1 of 1.

USATHAMA Method Code	Matrix Type	Analyte	Certified Reporting Limits ($\mu\text{g/g}$)	
			Lower CRL	Upper CRL
B-6	Animals and Plants	Arsenic	0.25	5.0
C-6	Animals and Plants	Mercury	0.050	0.40
D-6	Plants	Aldrin	0.02	0.3
		Dieldrin	0.04	0.3
		Endrin	0.04	0.6
E-6A	Animals	Aldrin	0.02	0.3
		Dieldrin	0.03	0.3
		Endrin	0.04	0.6
F-6A	Animals	DDE	0.09	2
		DDT	0.3	4

Source: ESE, 1988m

Table ESA 2.6-3. Contaminant Levels in Terrestrial Ecosystems — Samples of Species Ranging Across RMA Page 1 of 3.

Species	Tissue	Location	Contaminant Level in mg/kg Wet Weight Basis (Range/mean*)					p,p-DDT (n/nt)
			Arsenic (n/nt)	Mercury (n/nt)	Aldrin (n/nt)	Dieldrin (n/nt)	Endrin (n/nt)	
Invertebrates								
Earthworms	Whole	RMA, South Plants	BDL (1)	<0.050->2.4 (1/2)	BDL (1)	2 (1)	BDL (1)	BDL (1)
	Whole	RMA Control (Section 5 - ESA)	0.618-1.53(8/8) 1.03	<0.050-0.25 (2/8)	BDL (7)	<0.06-5 (1/7)	<0.08-0.9 (1/7)	BDL (8)
Whole	Offpost Control		BDL (2)	BDL (2)	BDL (1)	BDL (1)	BDL (1)	BDL (1)
Grasshoppers	Whole	RMA Section 26	BDL (4)	BDL (4)	0.05-6 (4/4) 2	0.5-7 (4/4) 3	<0.06-2 (3/4) 0.5	BDL (4)
		Section 36	0.91-6.6 (4/4) 3.2	<0.050-0.11 (2/4) 0.058	BDL (4)	0.3-0.4 (4/4) 0.4	BDL (4)	BDL (4)
		RMA Control (Section 7 and 8 - ESA)	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)	BDL (3)
	Offpost Control		BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)

* = Mean is calculated when 50 percent or more of samples have detectable contaminant levels. If less than 50 percent of samples have detectable contaminant levels, only the range of values are presented. When calculating the mean, values of 1/2 the detection limit are substituted for samples that are below the detection limit.

** = MKE sample.

BDL = Below Detection Limit.

NRQ = Not requested.

n = Number of samples analyzed that contain detectable contaminant levels.

nt = Number of samples.

TSY = Toxic Storage Yard

Source: ESE, 1988m

ESA Tab 2.6-3 Species

Rev. 5/10/89

Table ESA 2.6-3. Contaminant Levels in Terrestrial Ecosystems — Samples of Species Ranging Across RMA. Page 2 of 3.

Species	Tissue	Location	Contaminant Level in mg/kg Wet Weight Basis (Range/mean*)					p,p-DDT (n/nt)
			Arsenic (n/nt)	Mercury (n/nt)	Aldrin (n/nt)	Dieldrin (n/nt)	Endrin (n/nt)	
Vertebrates								
Ring-necked Pheasant	Juvenile	RMA	<0.25 - 1.8 (3/11)	BDL (11)	BDL (12)	<0.03 - 1 (5/12)	BDL (12)	BDL (11)
	Adult	RMA	BDL (4)	BDL (4)	BDL (4)	<0.03 - 3 (3/4) 0.8	BDL (4)	BDL (3)
	Egg	RMA	NRQ	0.050 - 0.41 (8/34)	BDL (33)	<0.03 - 4 (17/33) >0.5	BDL (33)	<0.09 - 1 (1/29)
	Egg	Offpost	NRQ	0.050 - 0.057 (1/11)	BDL (11)	BDL (11)	BDL (11)	<0.09 - 1 (2/11)
	Carcass	RMA Section 36 Summer	<0.25 - 0.74 (2/9)	BDL (9)	BDL (9)	0.2 - 10 (9/9) 2	BDL (9)	NRQ
Prairie Dog	Carcass	RMA Section 36 Winter	BDL (5)	BDL (5)	BDL (5)	0.1 - 6 (5/5) 1	BDL (5)	NRQ
	Carcass	ESA Toxic Storage Yard	<0.25 - 4.2 (1/5)	BDL (5)	BDL (5)	0.06 - 0.2 (5/5) 0.1	BDL (5)	NRQ
	Carcass	RMA Control Summer	BDL (9)	BDL (9)	BDL (9)	<0.03 - 0.3 (2/9)	BDL (9)	NRQ

* = Mean is calculated when 50 percent or more of samples have detectable contaminant levels. If less than 50 percent of samples have detectable contaminant levels, only the range of values are presented. When calculating the mean, values of 1/2 the detection limit are substituted for samples that are below the detection limit.

** = MKE sample.

BDL = Below Detection Limit.

NRQ = Not requested.

n = Number of samples analyzed that contain detectable contaminant levels.

nt = Number of samples.

TSY = Toxic Storage Yard

Source: ESE, 1988m

ESA Tab 2.6-3 Species
Rev. 5/10/89

Table ESA 2.6.3. Contaminant Levels in Terrestrial Ecosystems — Samples of Species Ranging Across RMA Page 3 of 3.

Species	Tissue	Location	Contaminant Level in mg/kg Wet Weight Basis (Range/mean*)					p,p-DDT (n/nt)
			Arsenic (n/nt)	Mercury (n/nt)	Aldrin (n/nt)	Dieldrin (n/nt)	Endrin (n/nt)	p,p-DDE (n/nt)
Carcass	RMA Control	Winter	BDL (5)	BDL (5)	BDL (5)	<0.03 - 0.1 (1/5)	BDL (5)	NRQ
Carcass	Offpost Control	Summer	BDL (9)	BDL (9)	BDL (8)	BDL (8)	BDL (8)	NRQ
Kidneys	RMA,	Section 36 Winter	BDL (5)	<0.10 0.36 (3/5) 0.18	BDL (5)	<0.2 - 2 (2/5)	BDL (5)	NRQ
Cottontail	Muscle	RMA,	BDL (7)	BDL (7)	BDL (7)	<0.03 - 0.09 (3/7)	BDL (7)	NRQ
		Section 36						
Muscle	RMA, Control		BDL (7)	BDL (7)	BDL (7)	BDL (7)	BDL (7)	NRQ
Muscle	RMA,	Offpost Control	BDL (7)	BDL (7)	BDL (7)	BDL (7)	BDL (7)	NRQ
Mule Deer	Liver	RMA	BDL (14)	BDL (14)	BDL (14)	<0.03 - 0.2 (1/14)	BDL (14)	NRQ
Liver	Offpost		BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	NRQ
Muscle	RMA		BDL (14)	BDL (14)	BDL (14)	BDL (14)	BDL (14)	NRQ
Muscle	Offpost		BDL (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)	NRQ

* = Mean is calculated when 50 percent or more of samples have detectable contaminant levels. If less than 50 percent of samples have detectable contaminant levels, only the range of values are presented. When calculating the mean, values of 1/2 the detection limit are substituted for samples that are below the detection limit.

** = MKE sample

BDL = Below Detection Limit

NRQ = Not requested

n = Number of samples analyzed that contain detectable contaminant levels

nt = Number of samples

TSY = Toxic Storage Yard

Source = FSE, 1988m

ESA Tab 2.6.3 Species

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Table ESA 2.6-4. Contaminant Levels in Terrestrial Ecosystems — Samples of Chance and USFWS Supplemental Samples of Species Ranging Across RMA Page 1 of 2.

Species	Tissue	Location	Contaminant Level in mg/kg Wet Weight Basis (Range/mean*)					P,p-DDT (n/nt)
			Arsenic (n/nt)	Mercury (n/nt)	Aldrin (n/nt)	Dieldrin (n/nt)	Endrin (n/nt)	P,p-DDE (n/nt)
Mourning Dove	Carcass	RMA	BDL (2)	BDL (2)	<0.6 - 2 1	6 - 60 (2/2) 30	<0.8 - 3 (1/2) 2	BDL (2)
	Liver	RMA	BDL (1)	BDL (1)	BDL (1)	7 (1)	4 (1)	BDL (1)
Bald Eagle	Egg	Barr Lake	BDL	0.10	BDL (1)	0.8 (1)	BDL (1)	BDL (1)
Golden Eagle	Liver	RMA	NKQ	<0.050 - 0.22 (1/2) 0.12	BDL (2)	<0.031 - 0.22 (1/2) 0.12	BDL (2)	BDL (2)
	Brain	RMA	BDL (2)	<0.098 - 0.26 (2)	BDL (2)	BDL (2)	BDL (2)	BDL (2)
Carrionous Hawk	Liver	RMA	BDL (5)	<0.050 - 0.29 (1/5)	BDL (5)	0.26 - 4.8 (5/5) 2.7	BDL (5)	BDL (5)
	Brain	RMA	BDL (5)	<0.050 - 0.15 (1/5)	BDL (5)	<0.24 - 1.0 (4/5)	BDL (5)	BDL (5)
Red-tailed Hawk	Liver	RMA	BDL (1)	<0.050 - 0.35 (1/3)	BDL (3)	0.5 - 7 (3/3) 4	BDL (3)	BDL (3)
	Brain	RMA	BDL (3)	<0.050 - 0.093 (1/3)	BDL (3)	<0.8 - 9 (2/3) 6	BDL (3)	BDL (3)
Great horned Owl	Liver	RMA	BDL (4)	<0.050 - 0.086 (2/4) 0.047	BDL (4)	0.1 - 30 (4/4) 10	BDL (4)	BDL (4)

* = Mean is calculated when 50 percent or more of samples have detectable contaminant levels. If less than 50 percent of samples have detectable contaminant levels, only the range of values are presented. When calculating the mean, values of 1/2 the detection limit are substituted for samples that are below the detection limit.

** = MKE sample.

BDL = Below Detection Limit.

NKQ = Not requested.

n = Number of samples analyzed that contain detectable contaminant levels.

nt = Number of samples

TSY = Toxic Storage Yard

Source: ESE, 1988m

SA 2.6.4/ESA-1

rev. 5/10.89

Table ESA 2.6-4. Contaminant Levels in Terrestrial Ecosystems — Samples of Chance and USFWS Supplemental Samples of Species Ranging Across RMA Page 2 of 2.

Species	Tissue	Location	Contaminant Level in mg/kg Wet Weight Basis (Range/mean*)					p,p-DDT (n/nt)
			Arsenic (n/nt)	Mercury (n/nt)	Aldrin (n/nt)	Dieldrin (n/nt)	Endrin (n/nt)	p,p-DDE (n/nt)
Northern Flamingo	Brain	RMA	BDL (4)	BDL (4)	BDL (4)	<0.2 - 20 9	BDL (4)	<0.5 - 10 3
	Egg	RMA	BDL (2)	BDL (2)	BDL (2)	0.3 - 0.7 (2) 0.5	BDL (2)	BDL (2)
Coyote	Liver	RMA	BDL (1)	BDL (1)	BDL (1)	8 (1)	BDL (1)	BDL (1)
Badger	Liver	RMA	BDL (1)	BDL (1)	BDL (1)	2 (1)	BDL (1)	NRQ
Kudzu	Kidneys	RMA	NRQ	NRQ	BDL (1)	0.8 (1)	BDL (1)	NRQ

* = Mean is calculated when 50 percent or more of samples have detectable contaminant levels. If less than 50 percent of samples have detectable contaminant levels, only the range of values are presented. When calculating the mean, values of 1/2 the detection limit are substituted for samples that are below the detection limit.

** = MKE sample

BDL = Below Detection Limit

NRQ = Not Requested

n = Number of samples analyzed that contain detectable contaminant levels

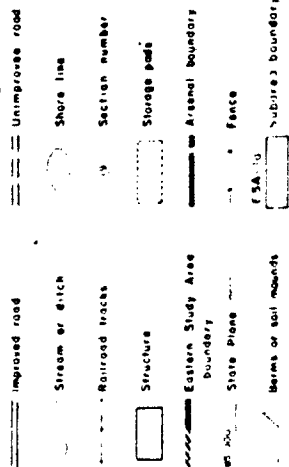
nt = Number of samples

TSY = Total Sample Yard

Source: FWS, 1995

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ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

○ Below Certified Reporting Limit (BCRL)

● 0.049 - 10

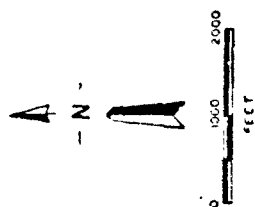
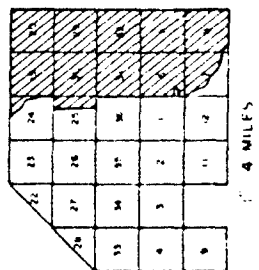
● >1.0 - 10

● >10 - 100

● >100

• Excluding Methylene Chloride

EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE - ESA 2.1-1
Volatile Halogenated Organics in Soils in
the 0-2 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

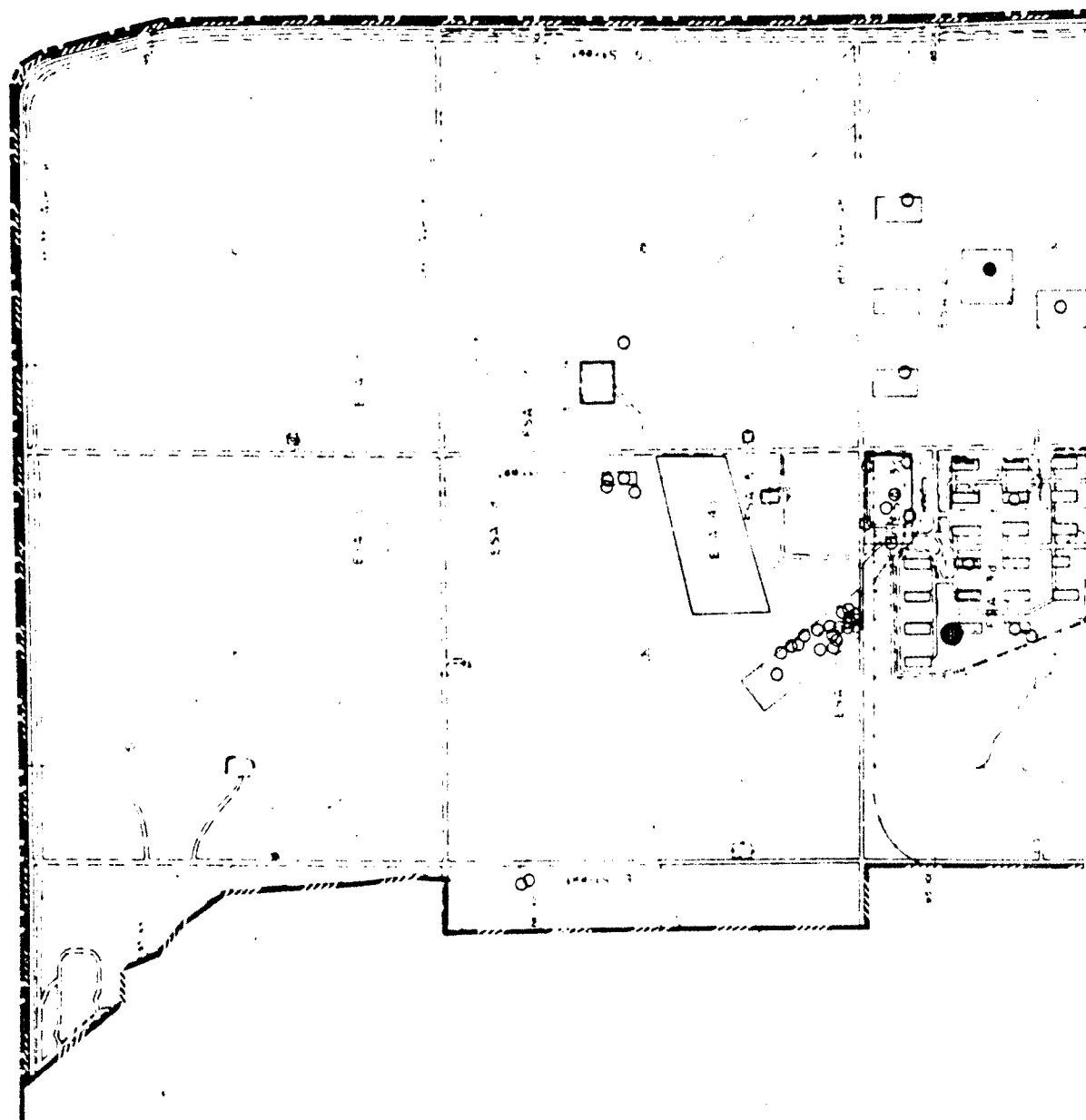
Legend

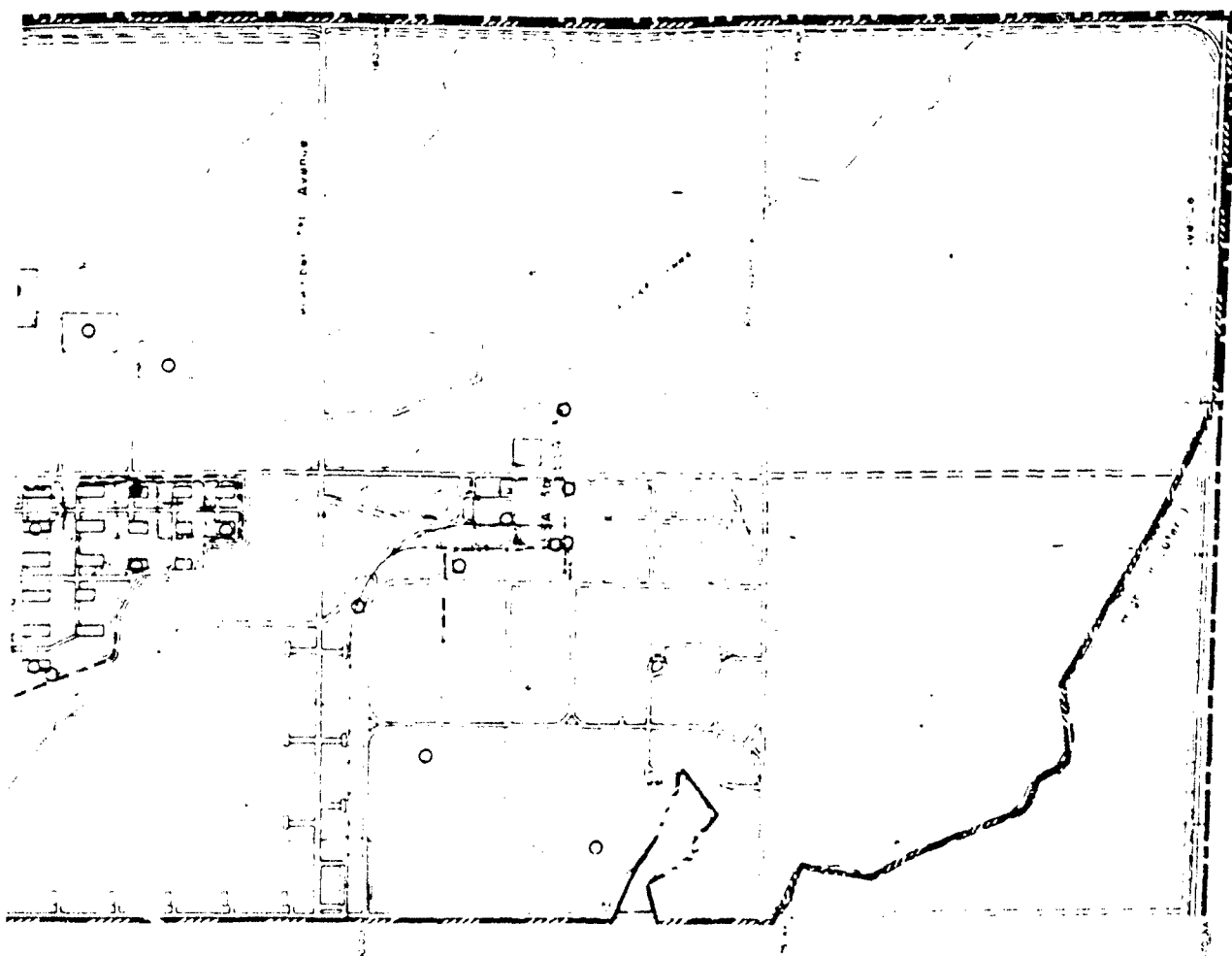
- == Improved road
- == Unimproved road
- ~ Stream or ditch
- Shore line
- Railroad tracks
- 12 Section number
- Structure
- Storage pods
- Eastern Study Area boundary
- State Plane grid
- Borneo or soil mound
- ESA-10
- Subarea boundary

ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

- Below Certified Reporting Limit (BCRL)
- 0.049 - 1.0
- > 1.0 - 10
- > 10 - 100
- > 100

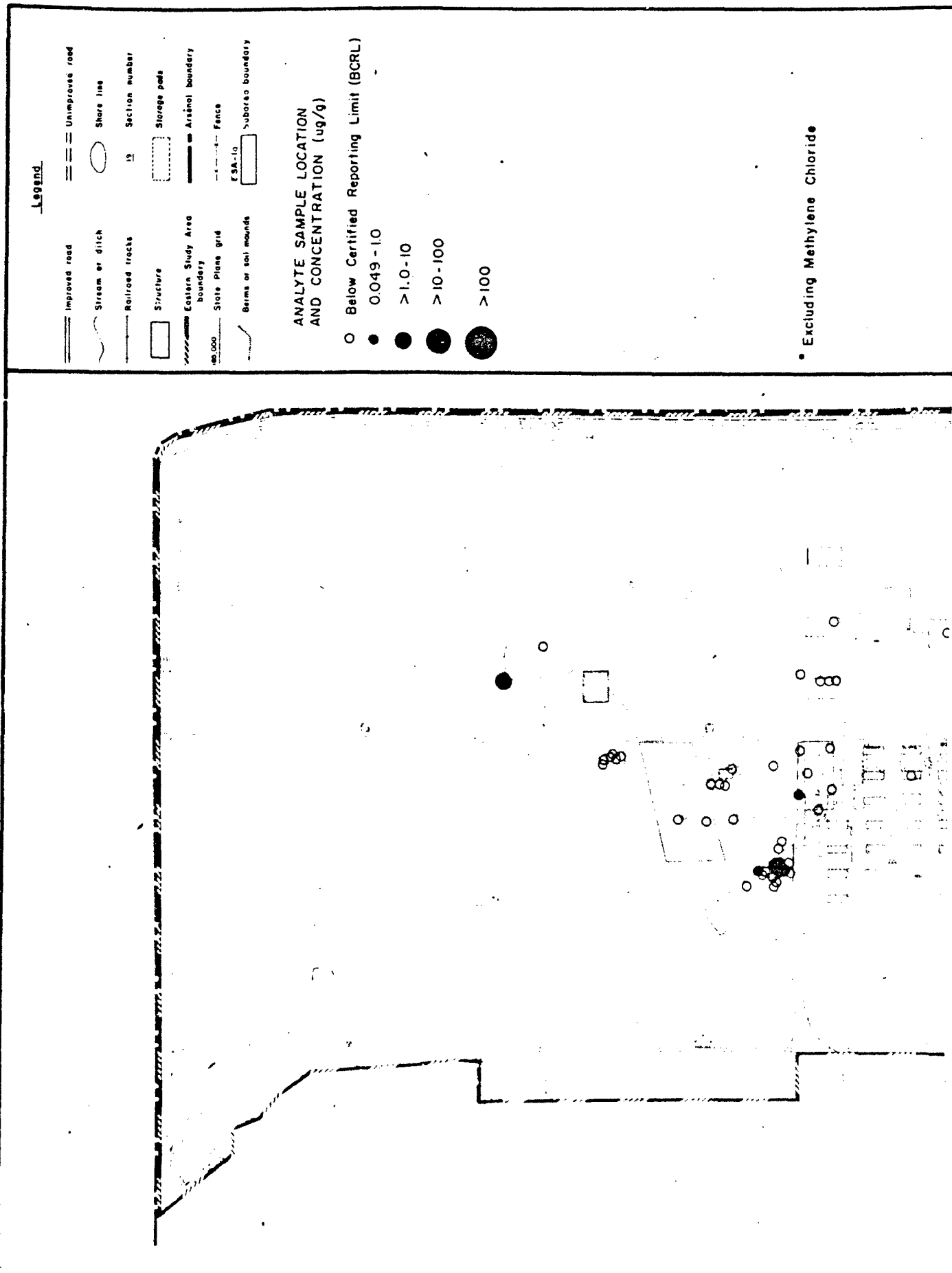
• Excluding Methylene Chloride

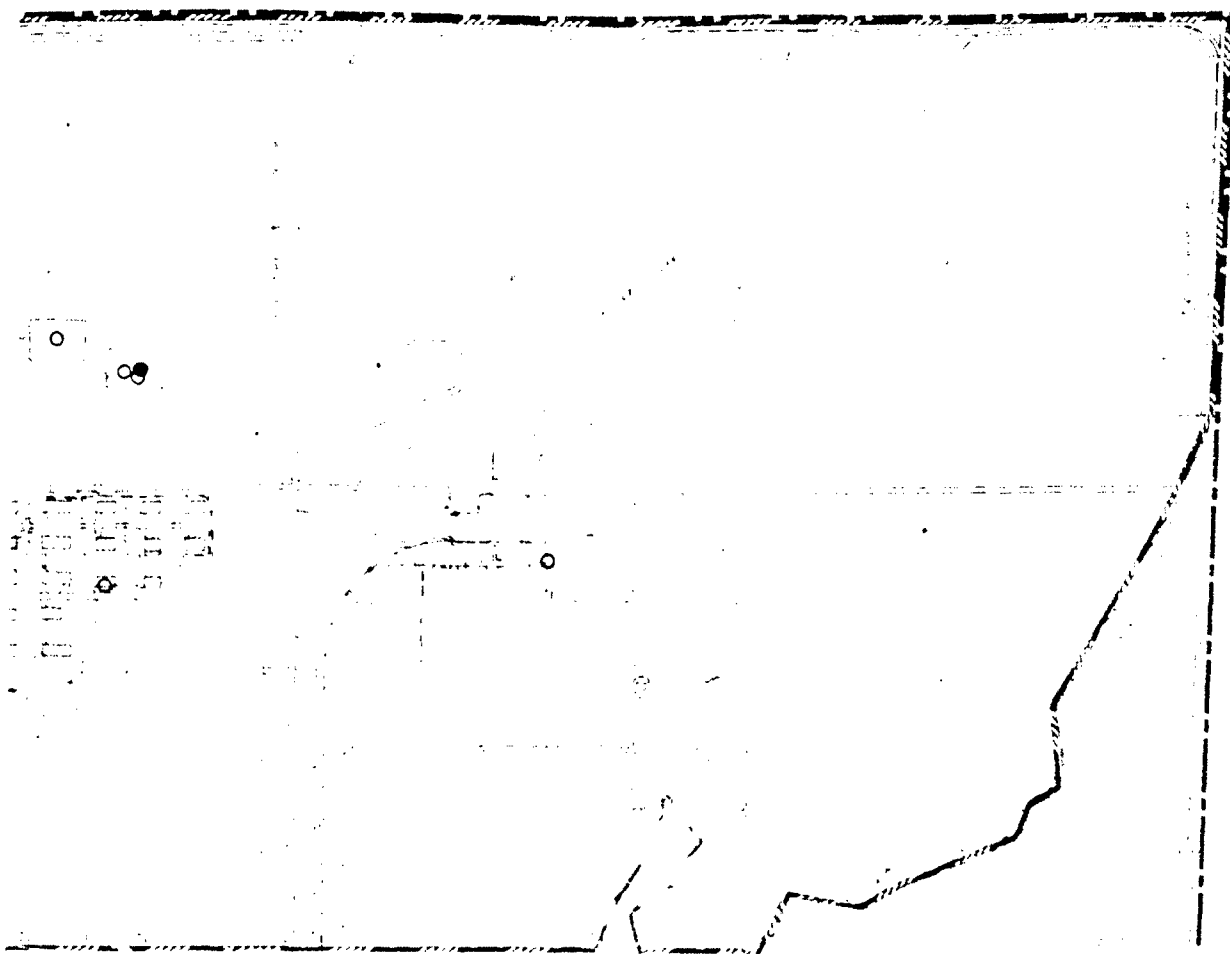




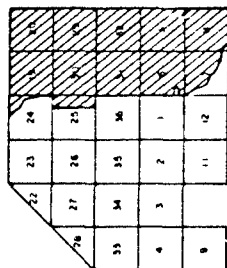
EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL

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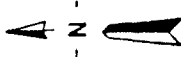




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



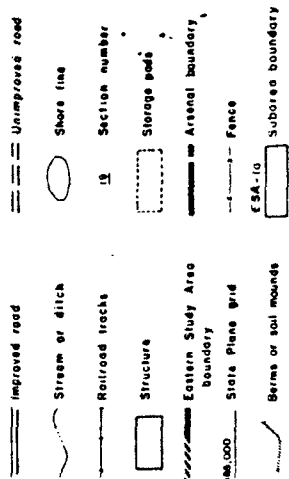
Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

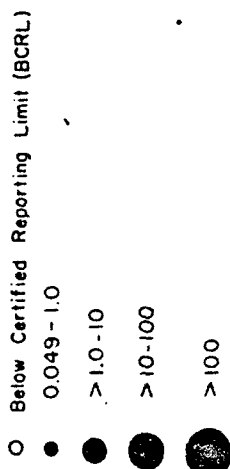
FIGURE ESA 2.1-3
Volatile Halogenated Organics in Soils in
the 5-20 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

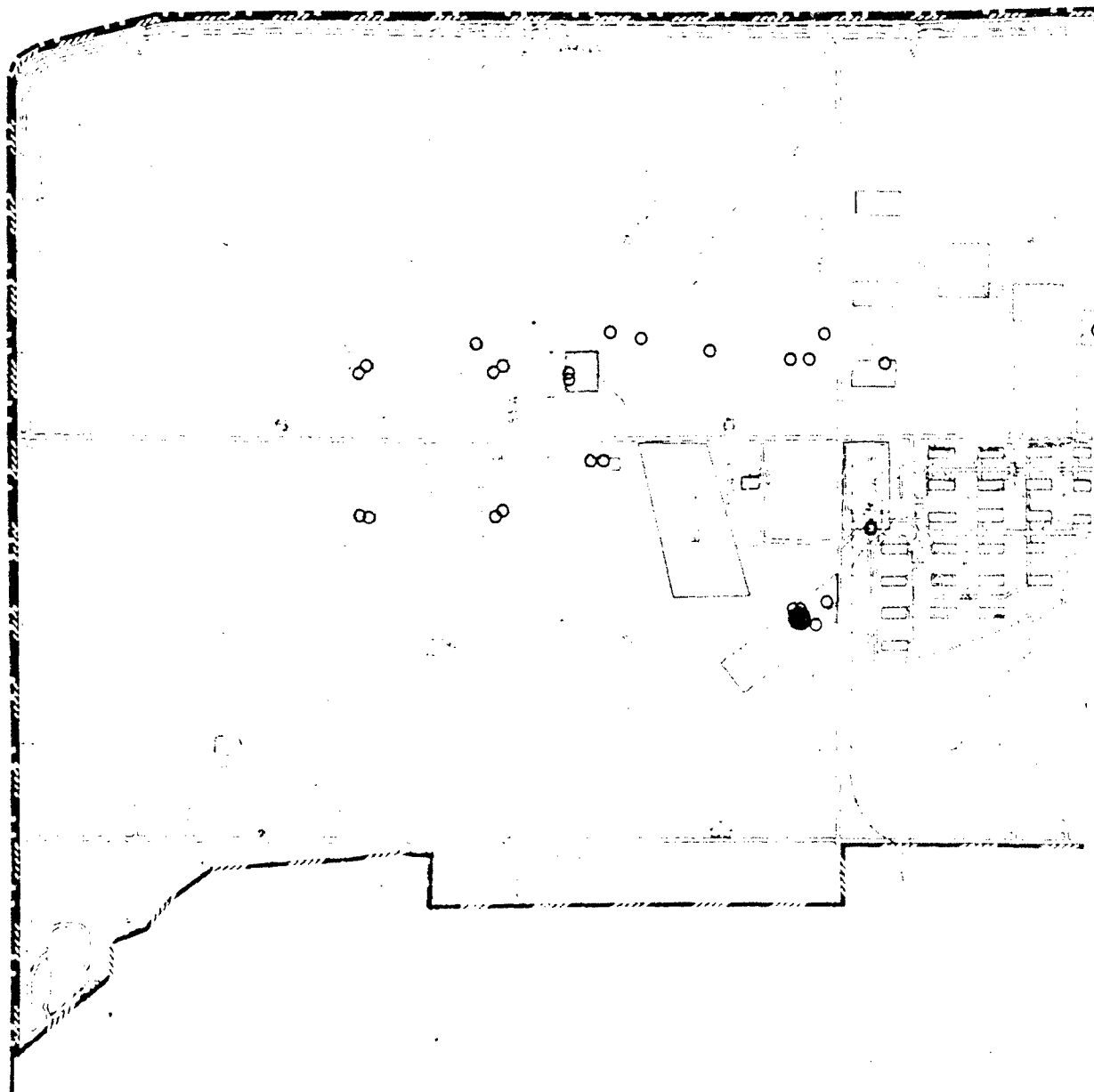
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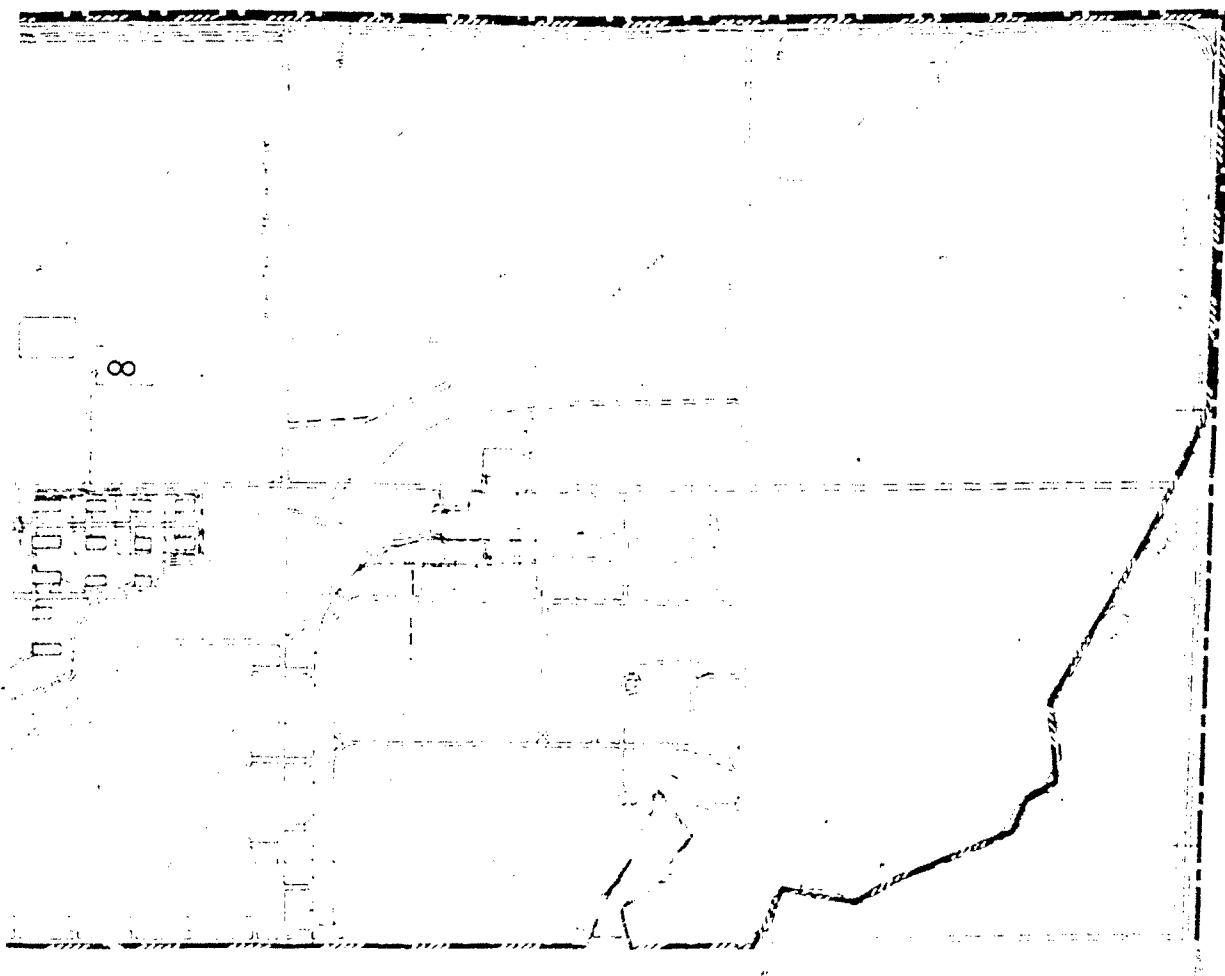


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

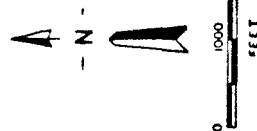
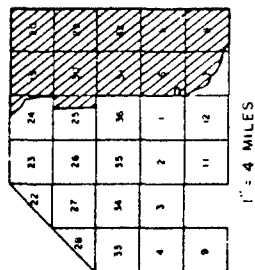


* Excluding Methylene Chloride





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE - ESA 2.1-4

Volatile Halogenated Organics in Soils in
the > 20 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

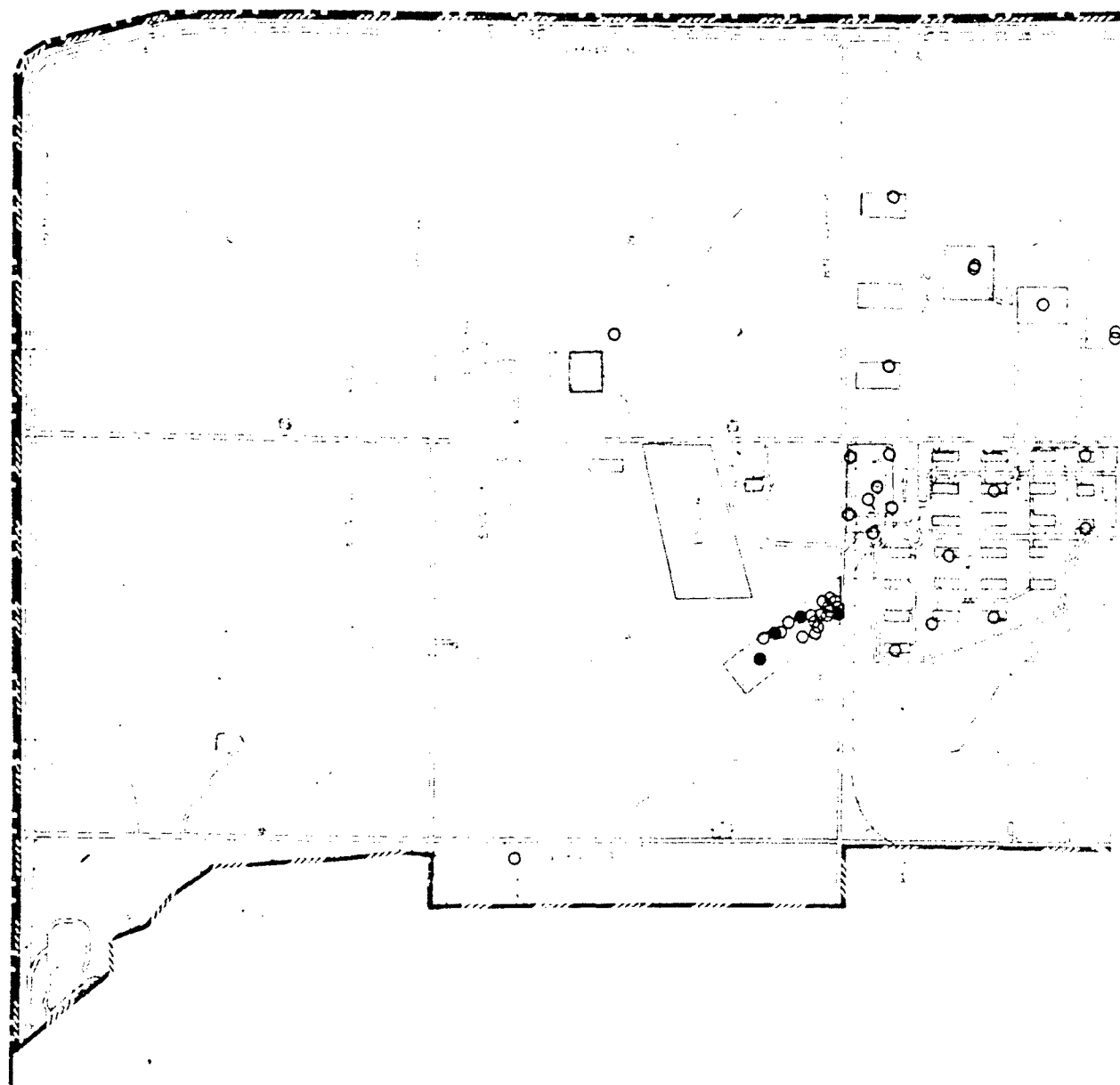
Legend

Impressed road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Section number
Structure	Storage pads
Eastern Study Area boundary	Aerial boundary
State Plane grid	Fence
Berms or soil mounds	ESA-10
	Subarea boundary

ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

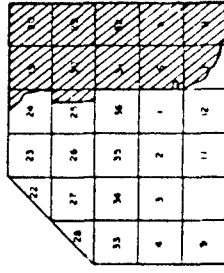
Below Certified Reporting Limit (BERL)
0.049-10
> 1.0-10
> 10-100
> 100

* A member of the VHO group, mapped separately due to its potential as a laboratory contaminant.

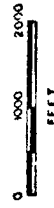
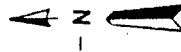




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



Prepared for:

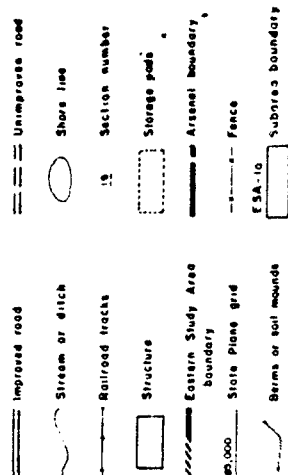
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.1-5

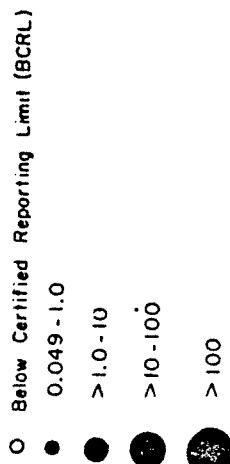
Methylene Chloride in Soils in the
2-5 ft. Depth Interval

Rocky Mountain Arsenal

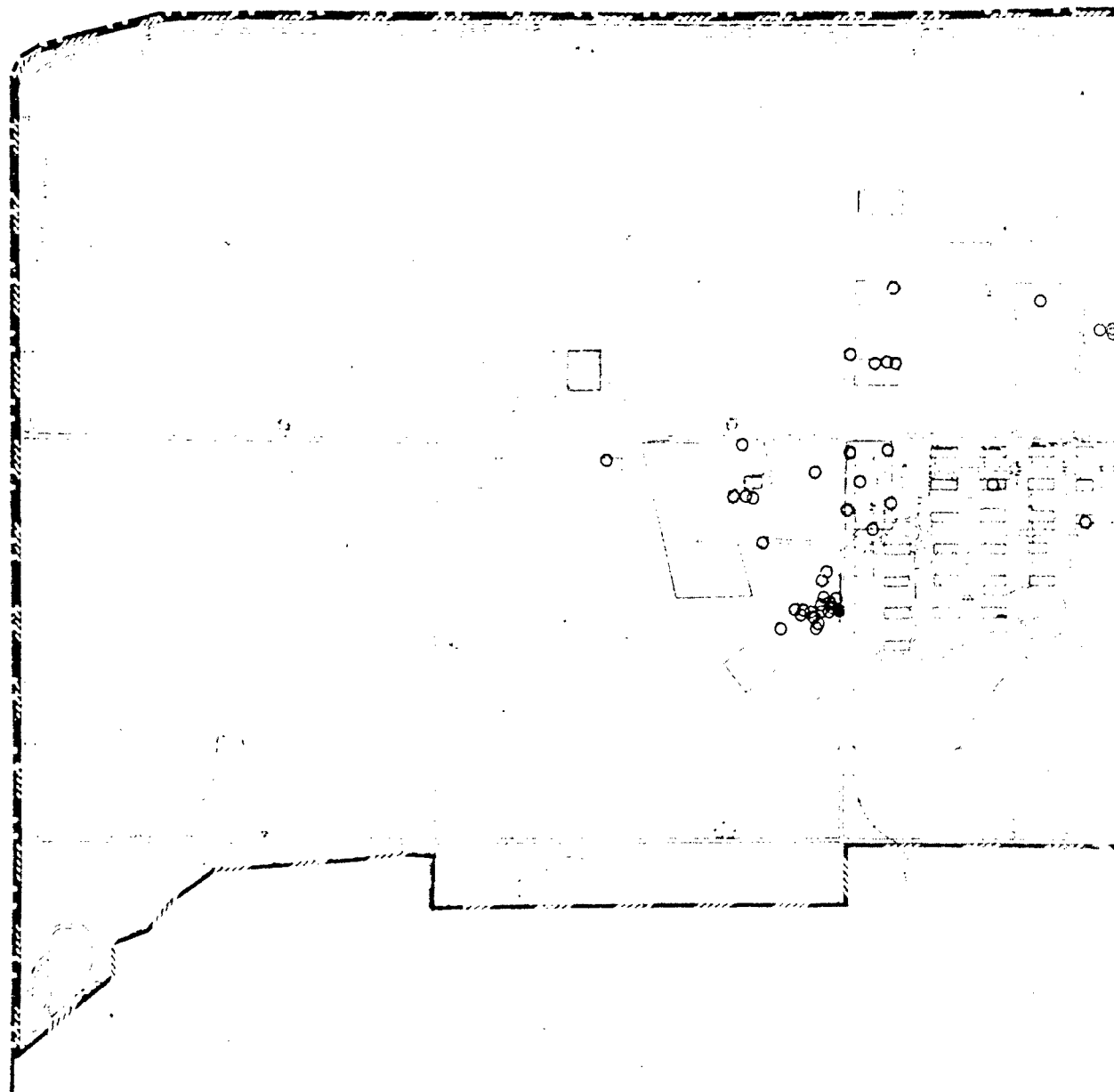
Legend

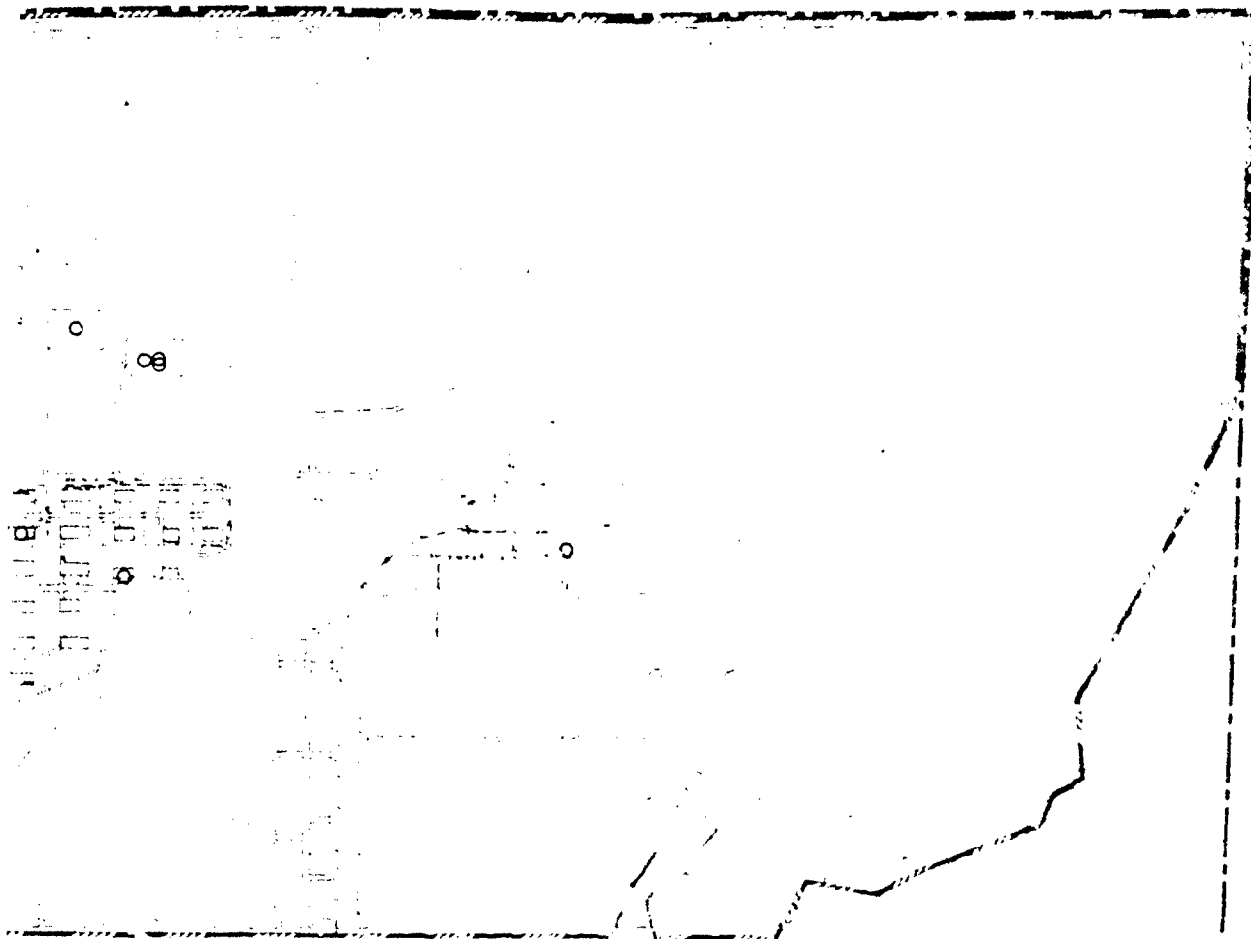


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

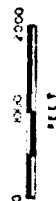
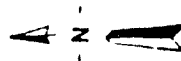
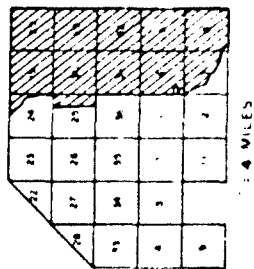


A member of the VHO group, mapped separately due to its potential as a laboratory contaminant.





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE - ESA 2.1 - 6
Methylene Chloride in Soils in the
5-20 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by Ebasco Services Incorporated

Legend

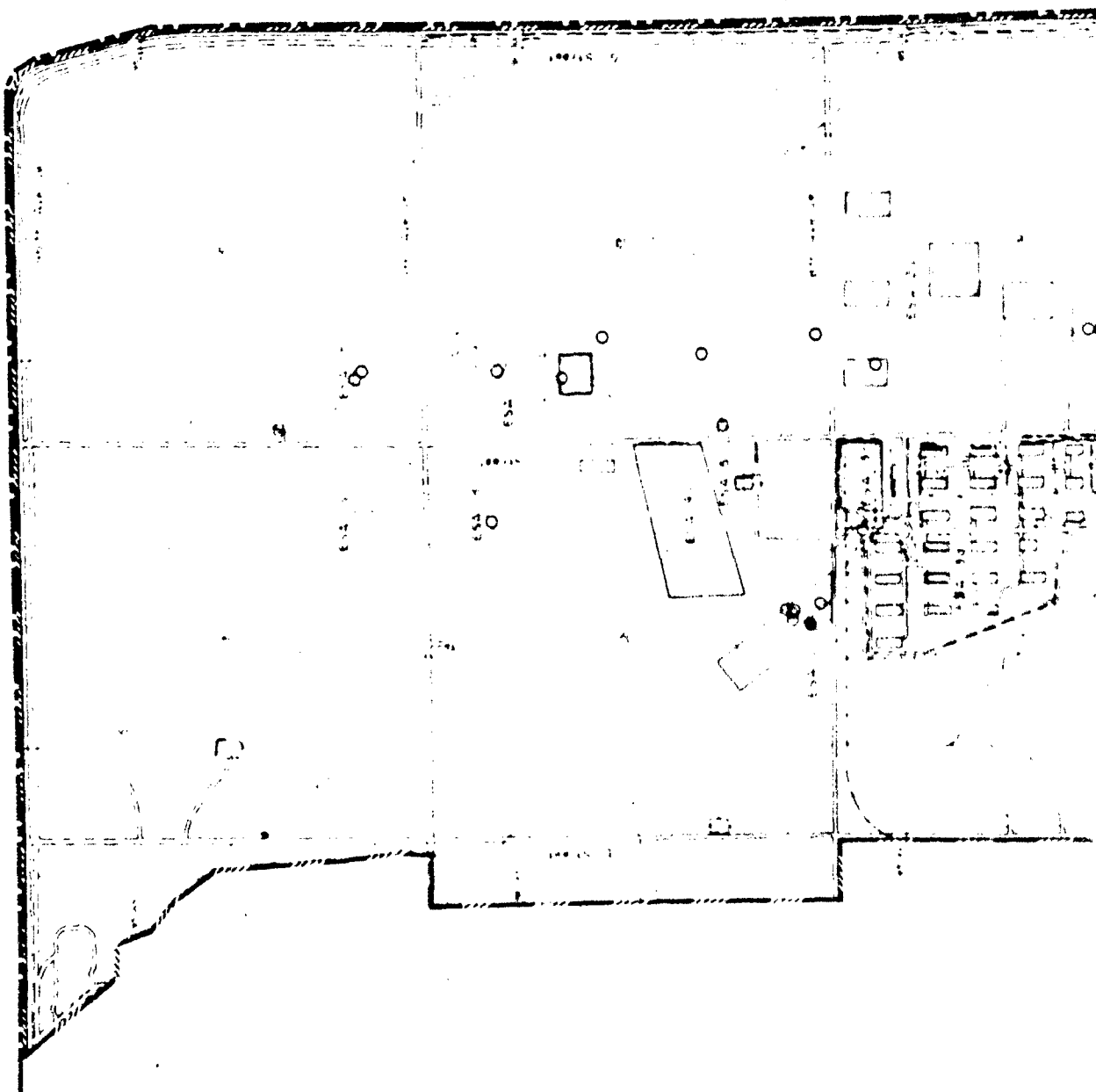
Improved road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Section number
Structure	Storage ponds
Eastern Study Area boundary	Aerial boundary
State Plane grid	Fence
Burns or soil mounds	ESA-10
	Subarea boundary

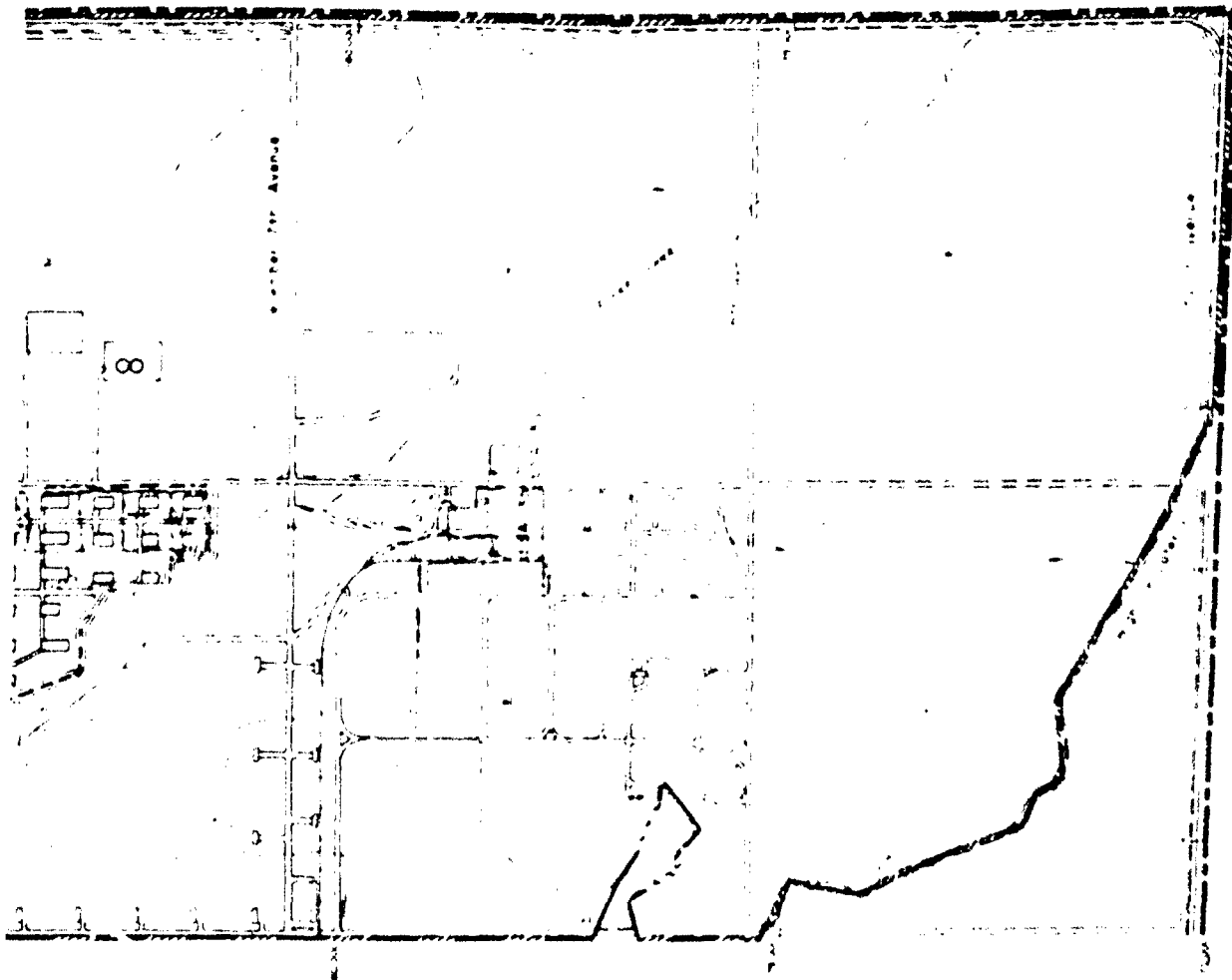
ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

Below Certified Reporting Limit (BCRL)

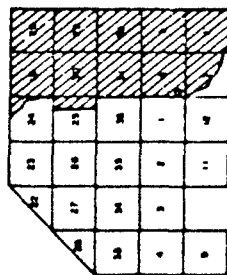
- 0.049 - 10
- > 1.0 - 10
- > 10 - 100
- > 100

A member of the VHO group, mapped separately due to its potential as a laboratory contaminant.

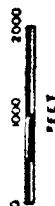
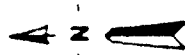




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



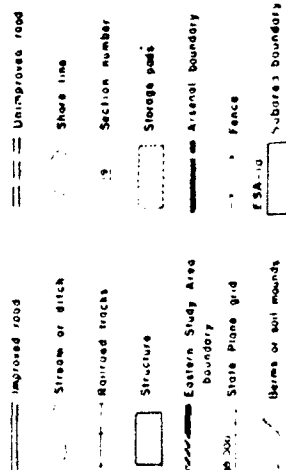
Prepared for:

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Rocky Mountain Arsenal Cleanup

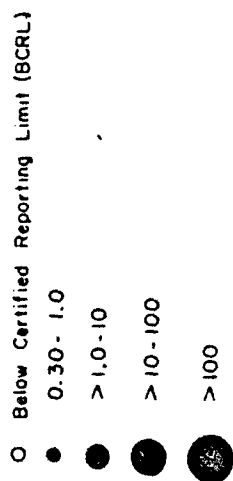
FIGURE ESA 2.1-7
Methylene Chloride[®] in Soils in the
> 20 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

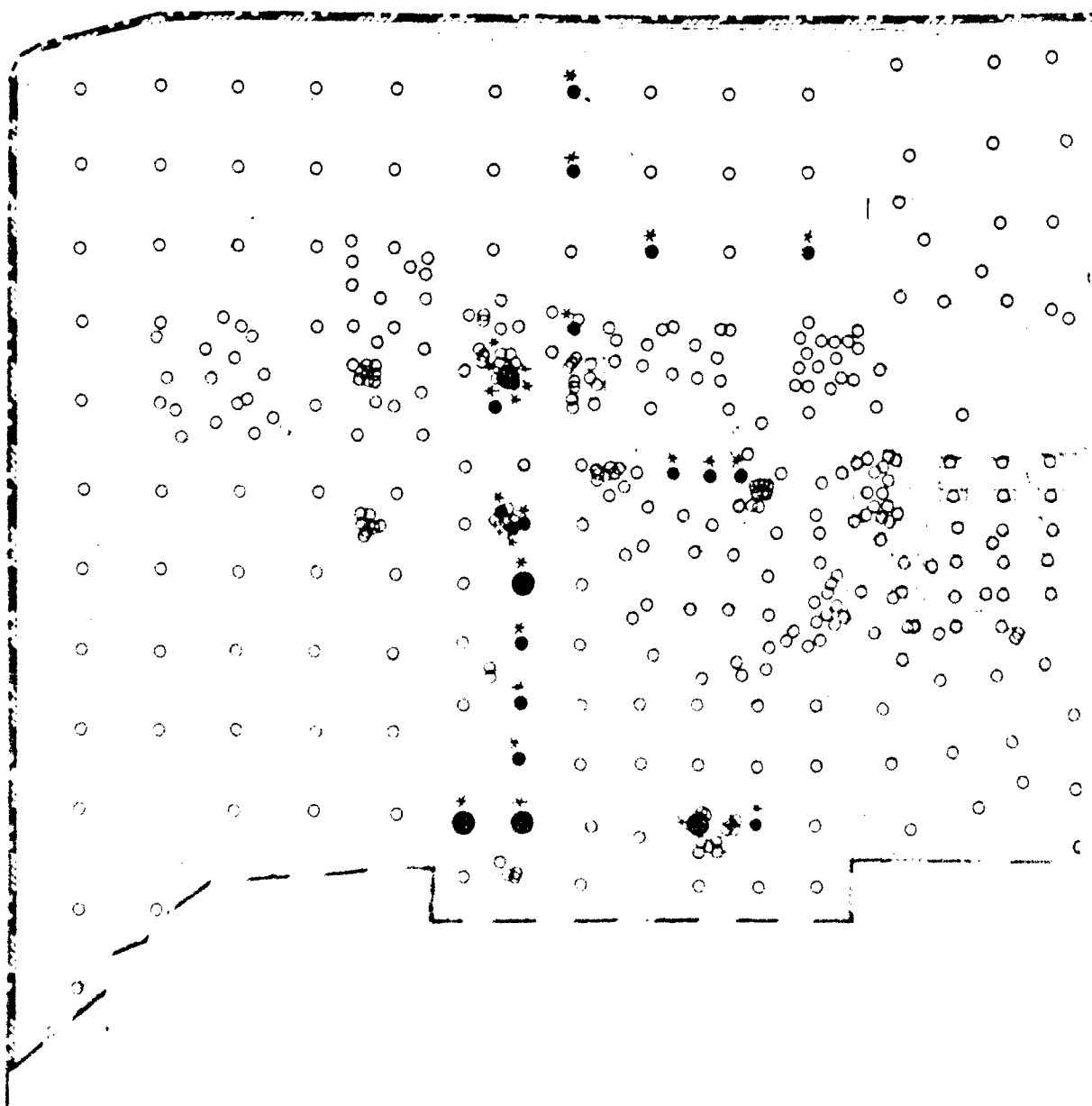
Legend

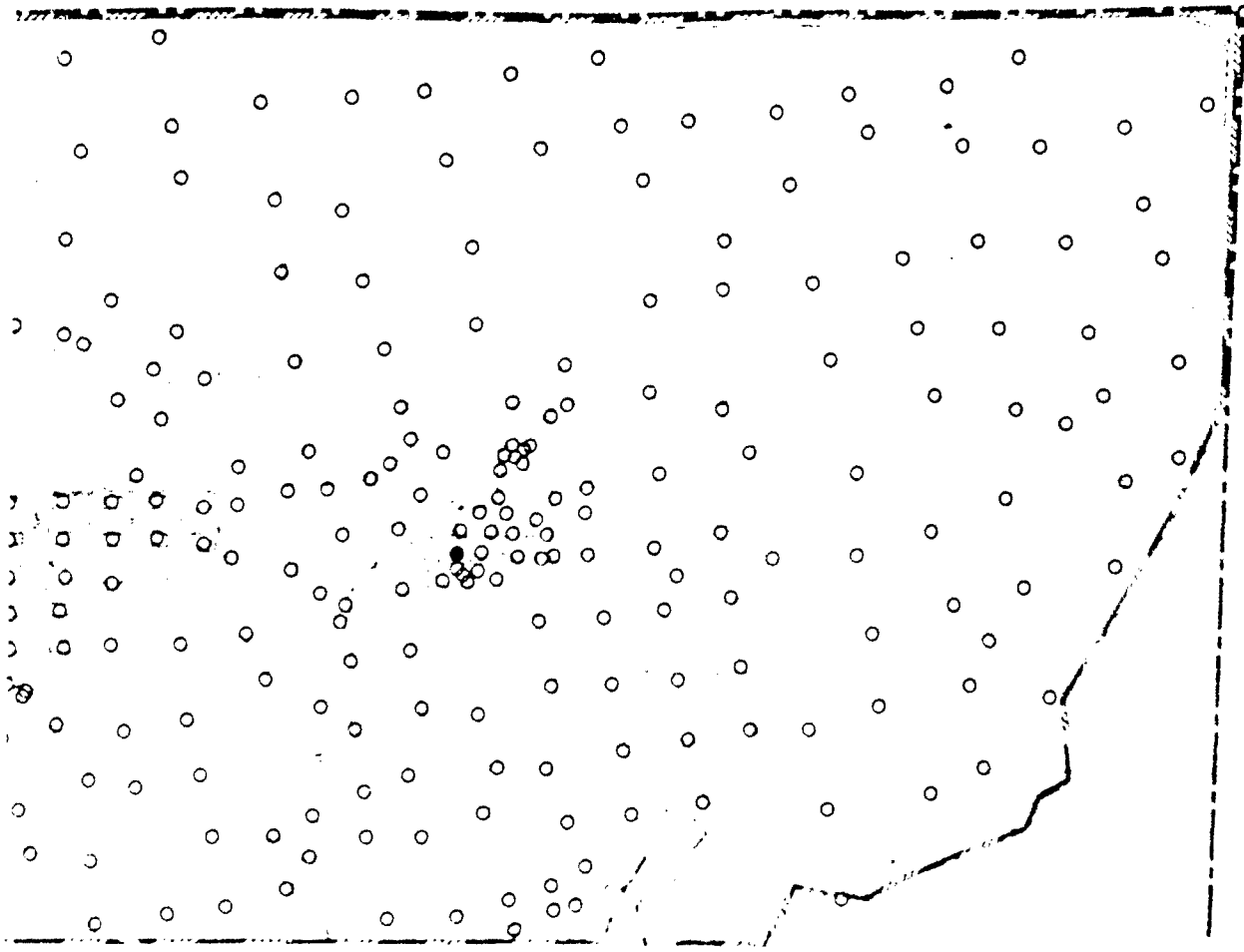


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

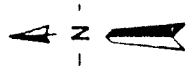
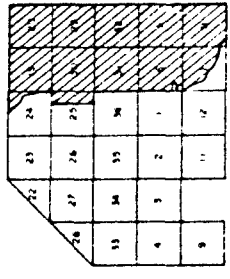


* Detections of 2,2-oxybisethanol, which are suspected to be field procedure contamination.





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL

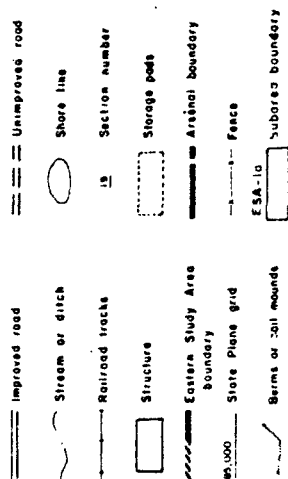


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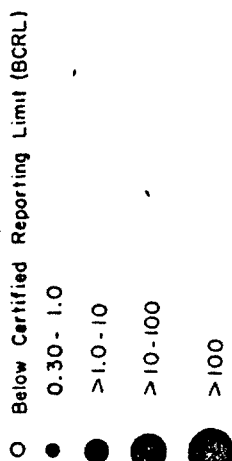
FIGURE - ESA 2.1-8
Volatile Hydrocarbons in Soils in the
0-2 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

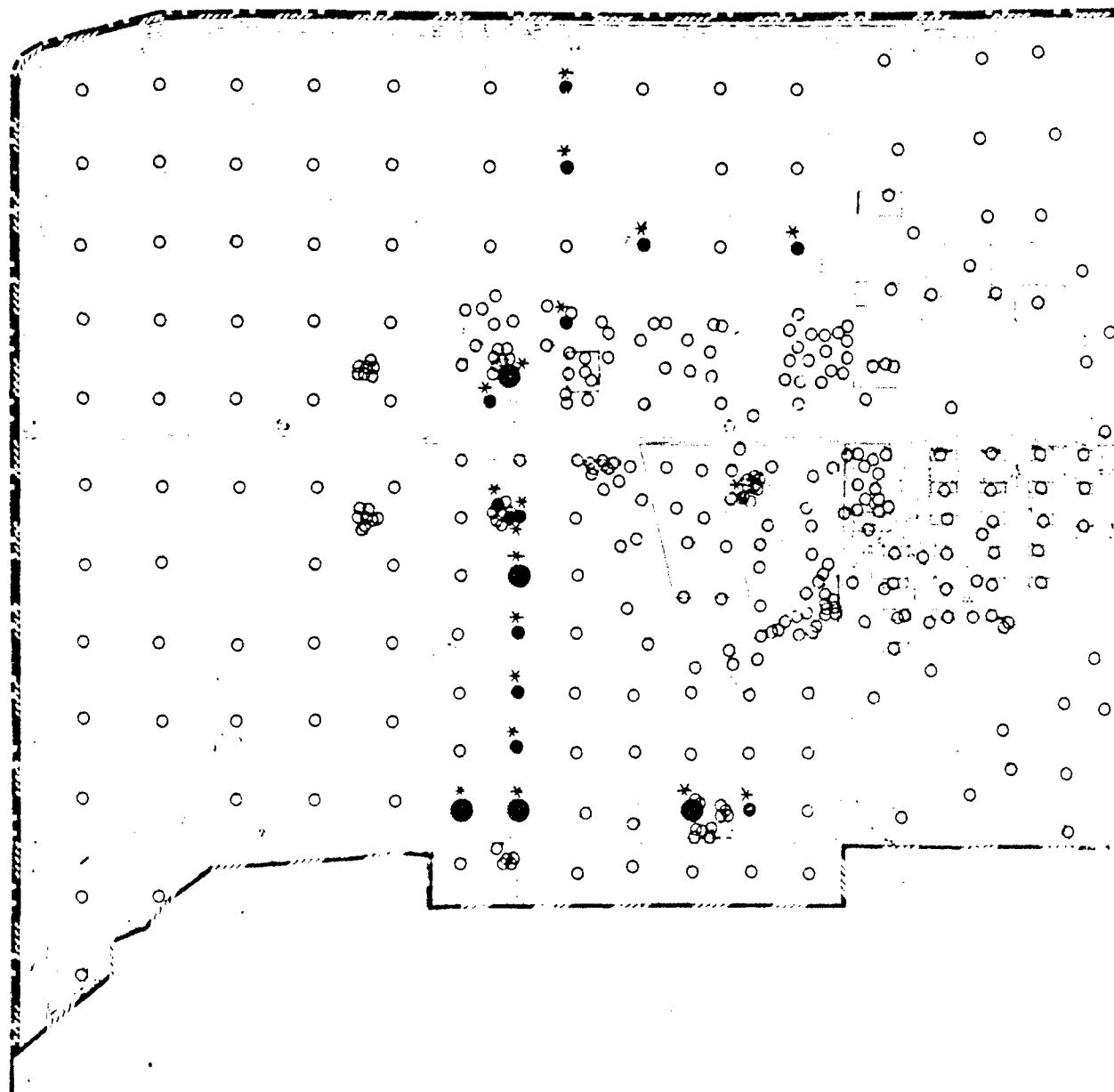
Legend

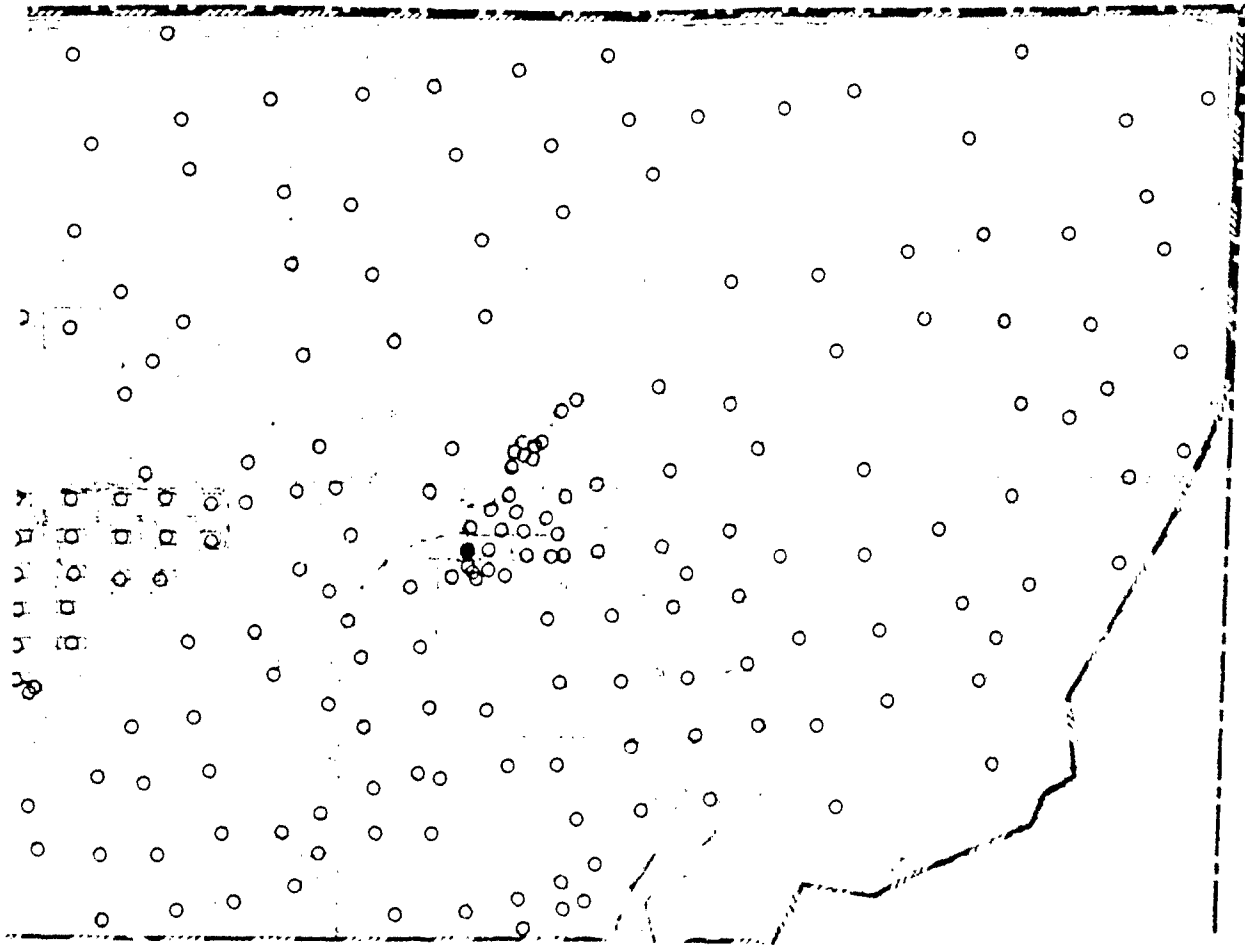


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

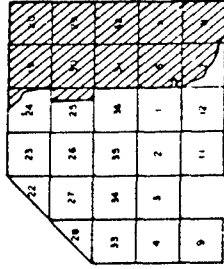


* Detections of 2,2-oxybisethanol, which are suspected to be field procedure contamination.

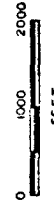
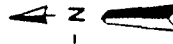




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



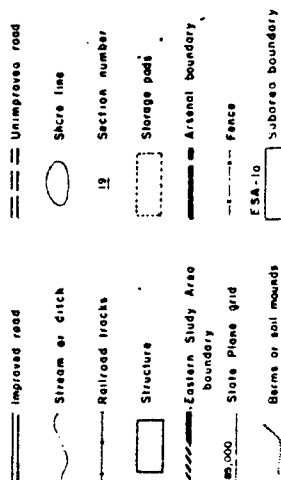
Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.1-9
Volatile Hydrocarbons in Soils in the
2-5 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend



ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

○ Below Certified Reporting Limit (BCRL)

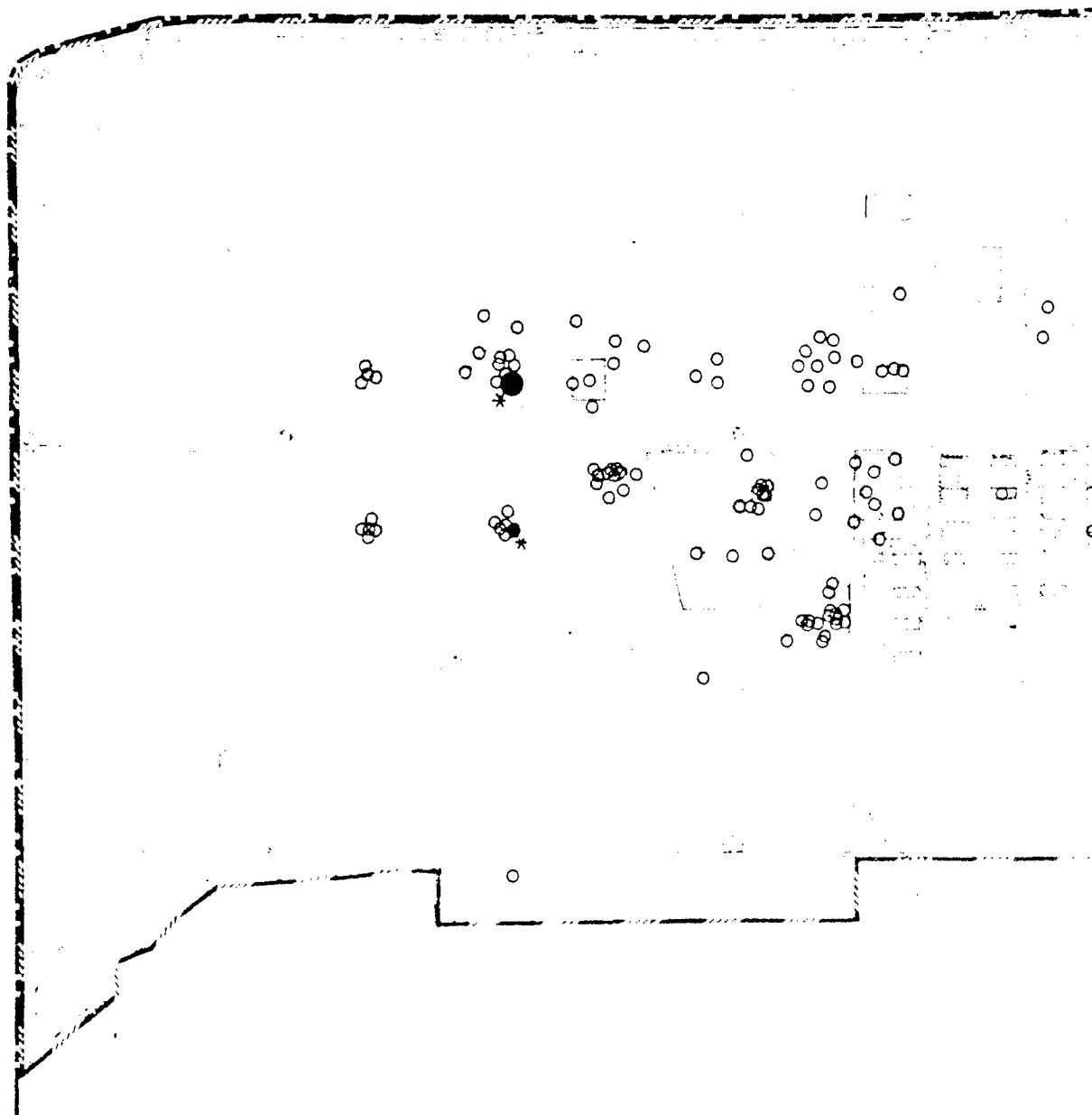
● 0.30 - 1.0

● >1.0 - 10

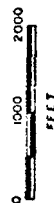
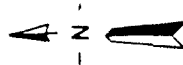
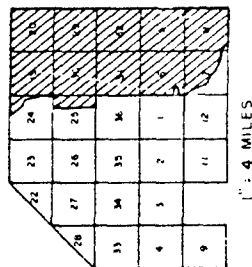
● >10 - 100

● >100

* Detections of 2,2-oxybisethanol, which are suspected to be field procedure contamination.



EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



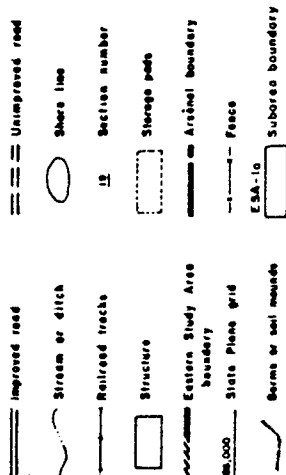
Prepared for:

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Rocky Mountain Arsenal Cleanup

FIGURE - ESA 2.1-10
Volatile Hydrocarbons in Soils in the
5-20 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend



ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

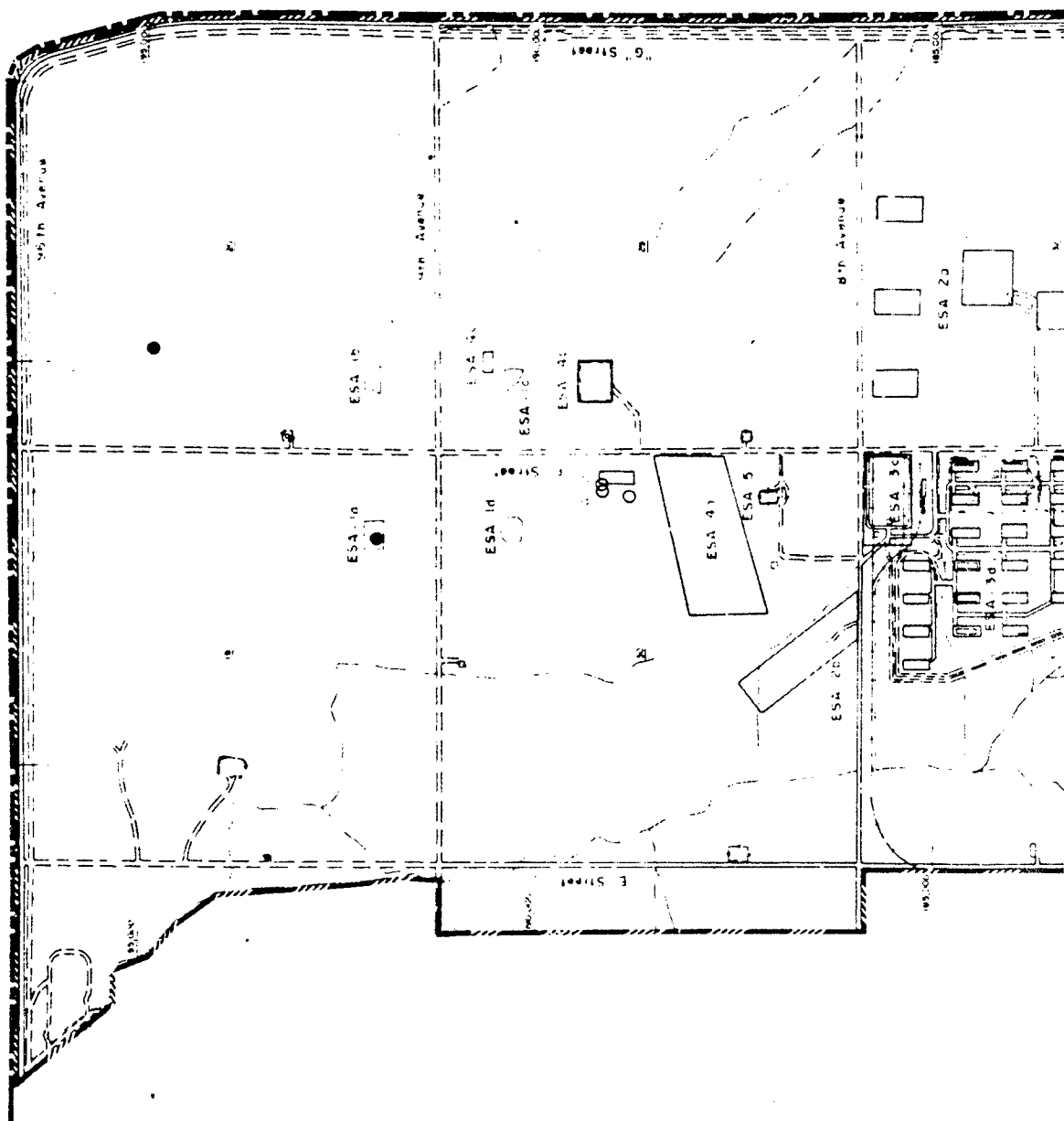
O Below Certified Reporting Limit (BCRL)

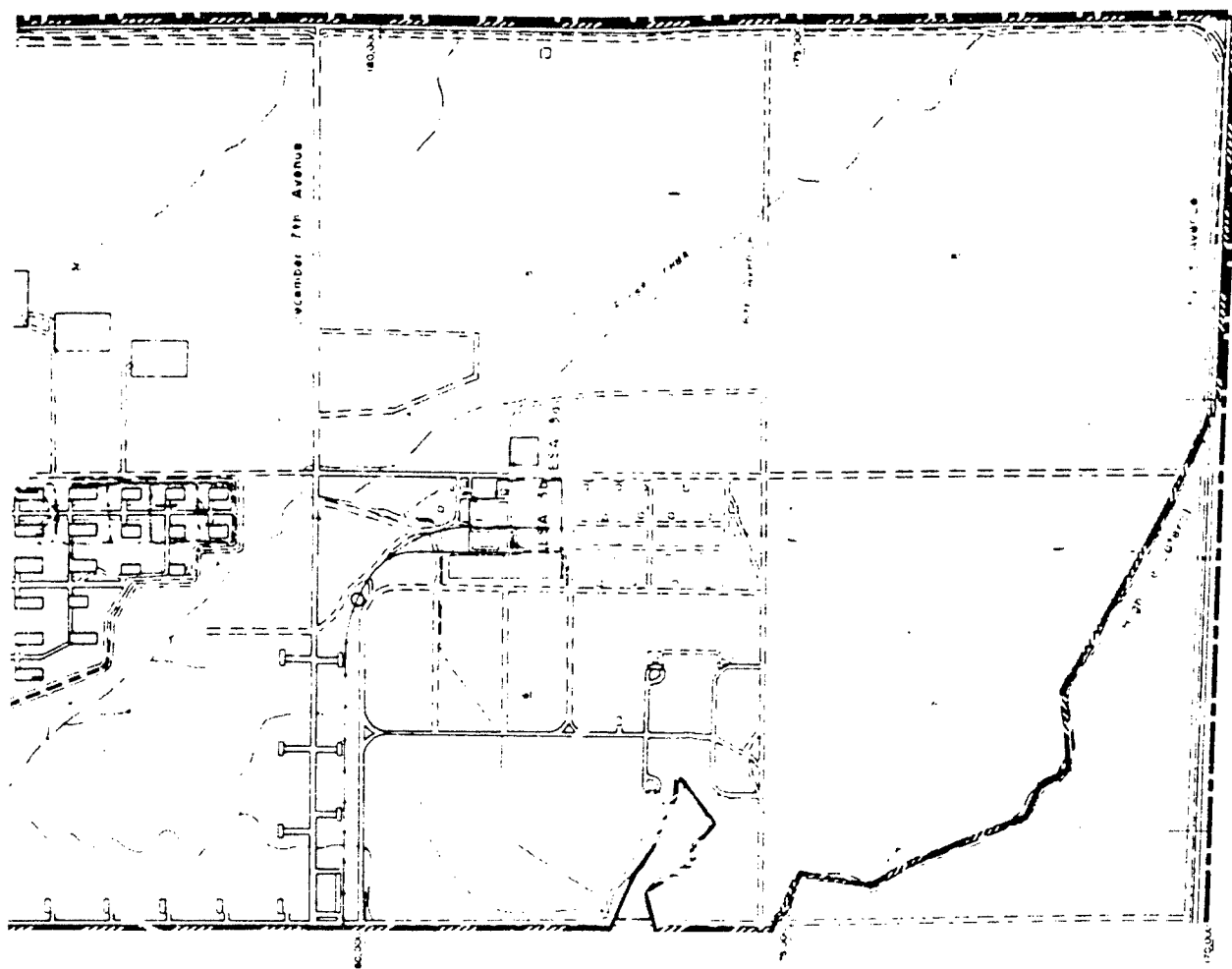
● 0.053 - 1.0

● >1.0 - 10

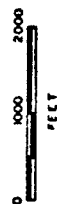
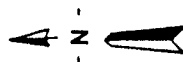
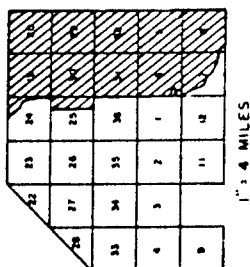
● > 10 - 100

● > 100





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



Prepared for:

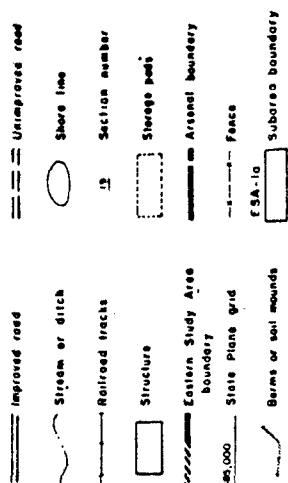
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Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.1-11

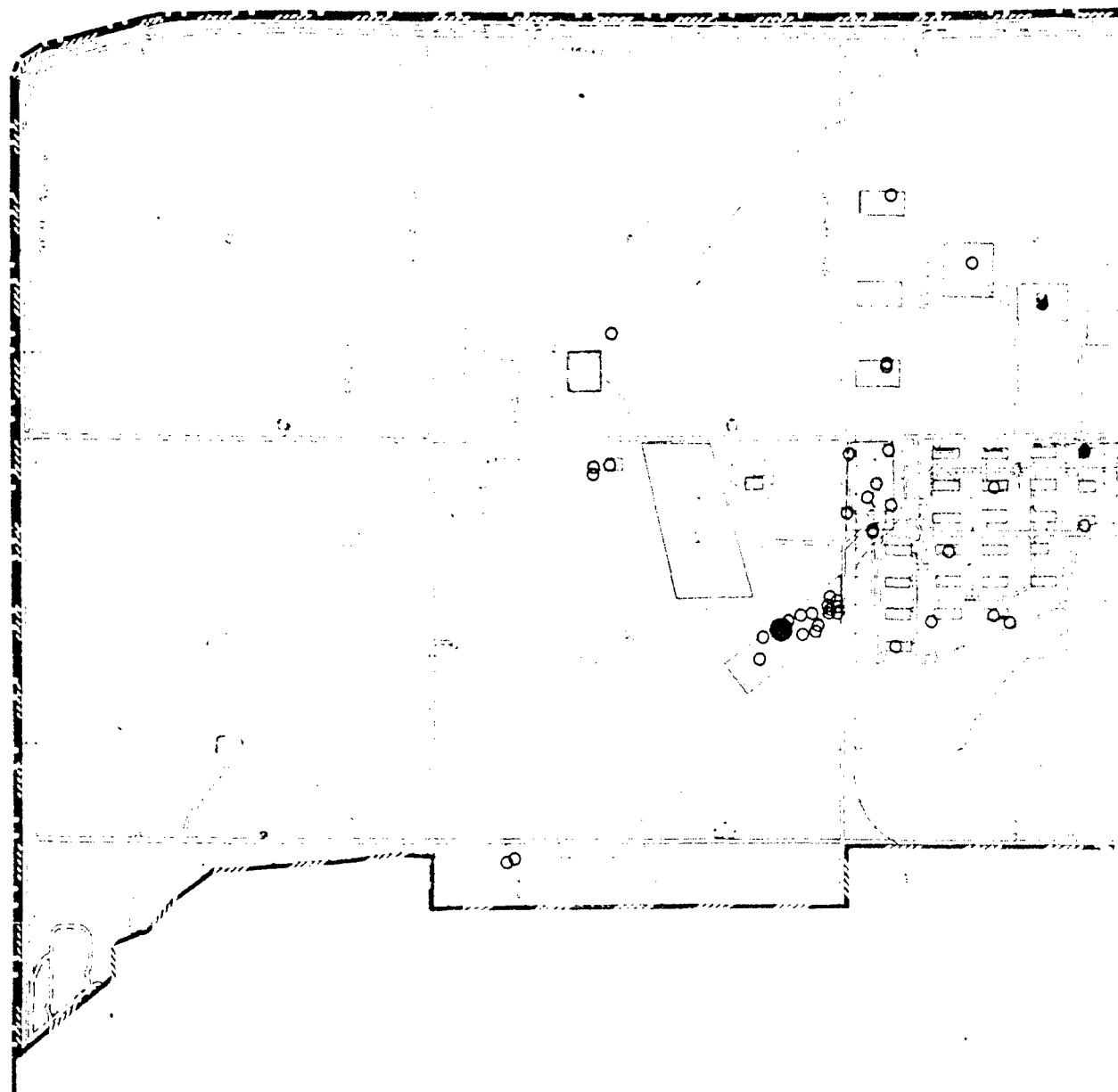
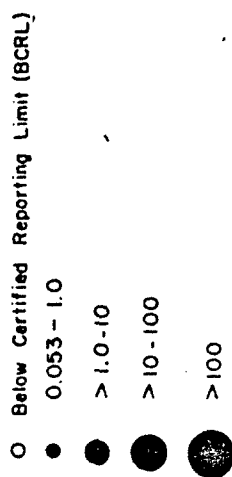
Volatile Aromatic Organics in Soils in the
0-2 ft. Depth Interval

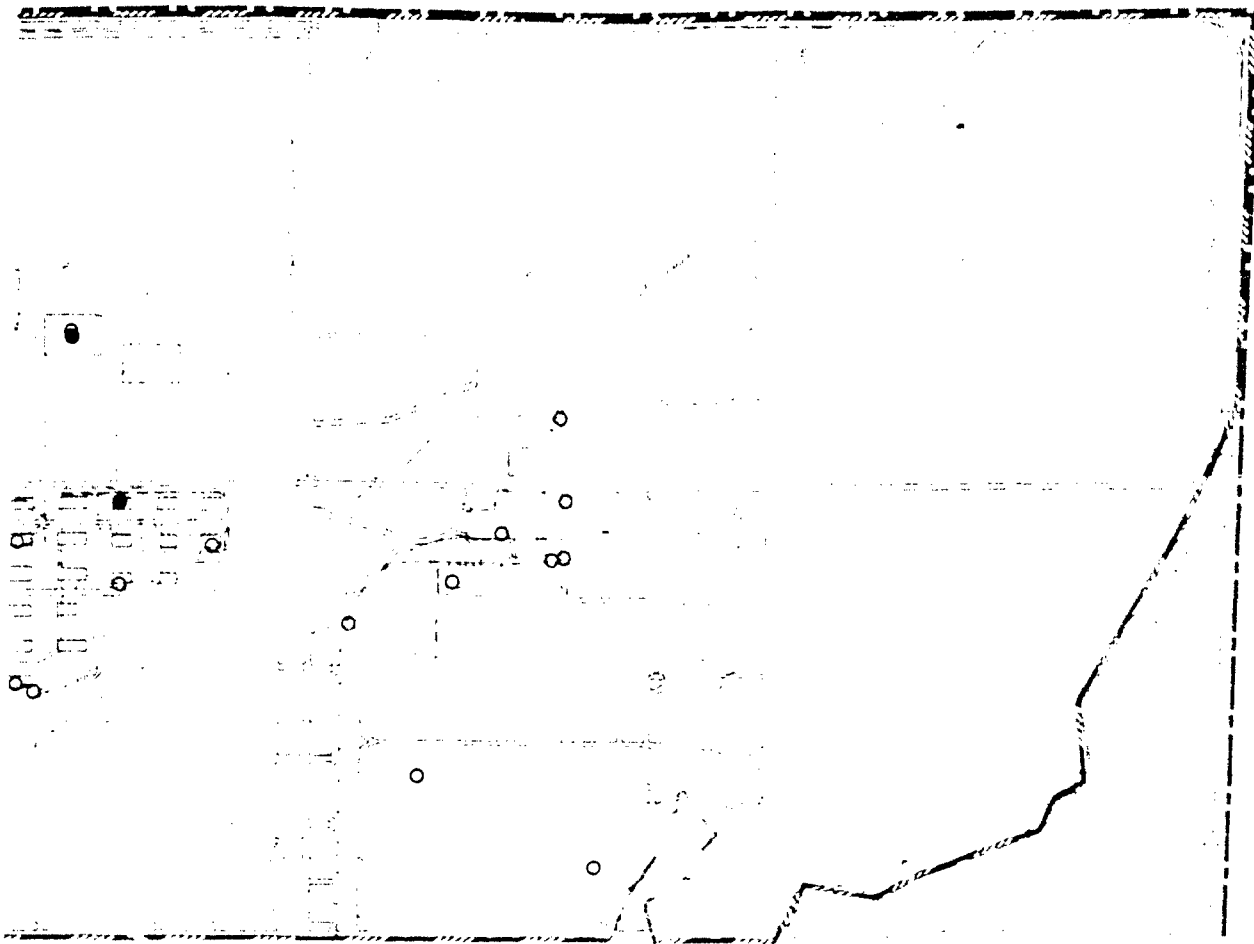
Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

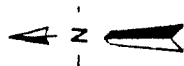
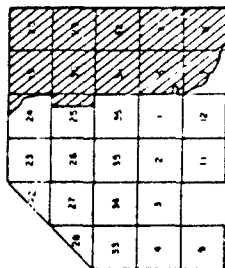


ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/g)





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



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FIGURE - ESA 2.1-12
Volatile Aromatic Organics in Soils in the
2-5 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

- Improved road
- Stream or ditch
- Railroad tracks
- Structure
- Eastern Study Area Boundary
- State Plane grid
- Barns or soil mounds
- Unimproved road
- Shore line
- Section number
- Storage pads
- Artificial boundary
- Fence
- ESA-10
- Subarea boundary

ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

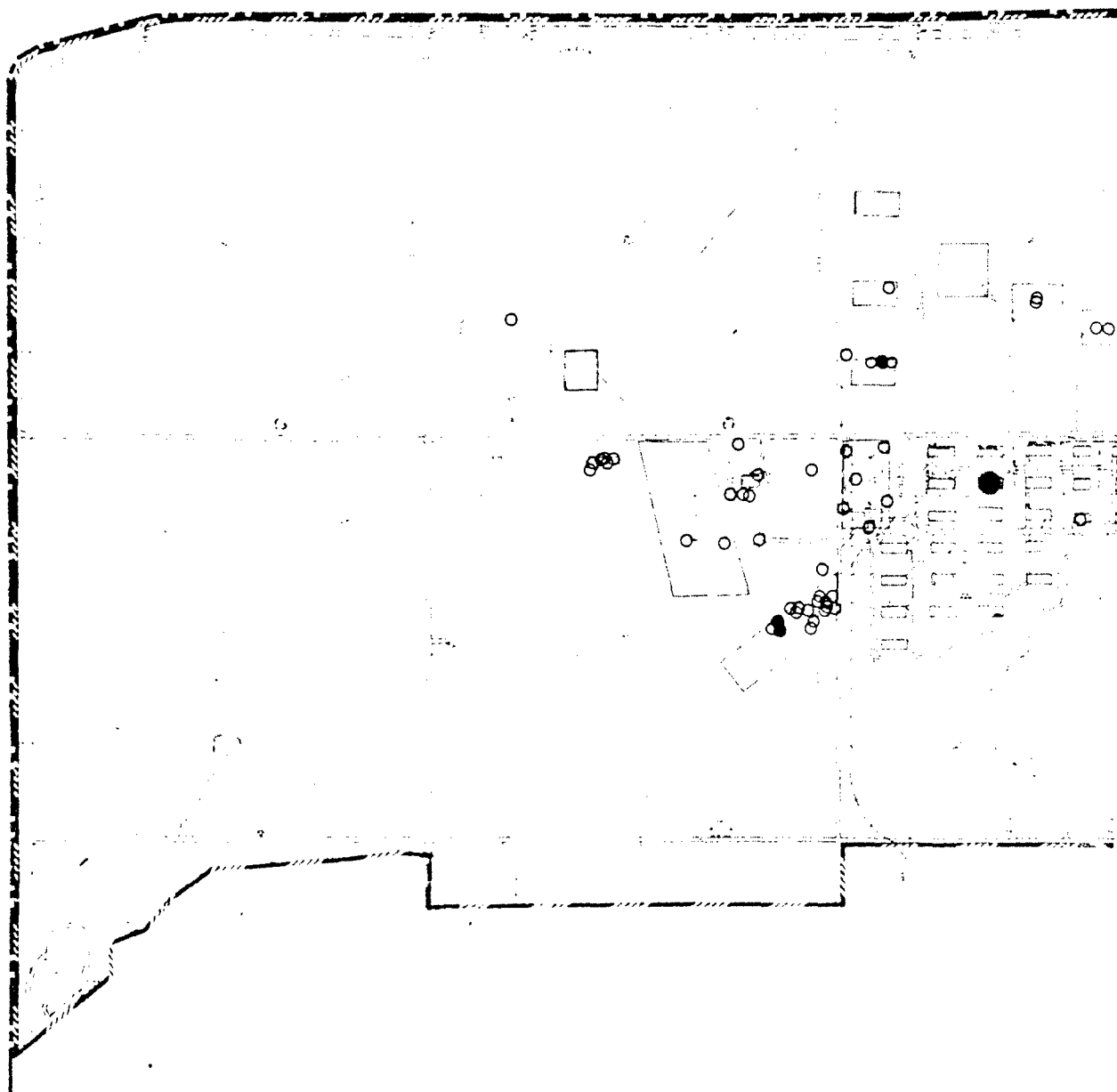
○ Below Certified Reporting Limit (BCRL)

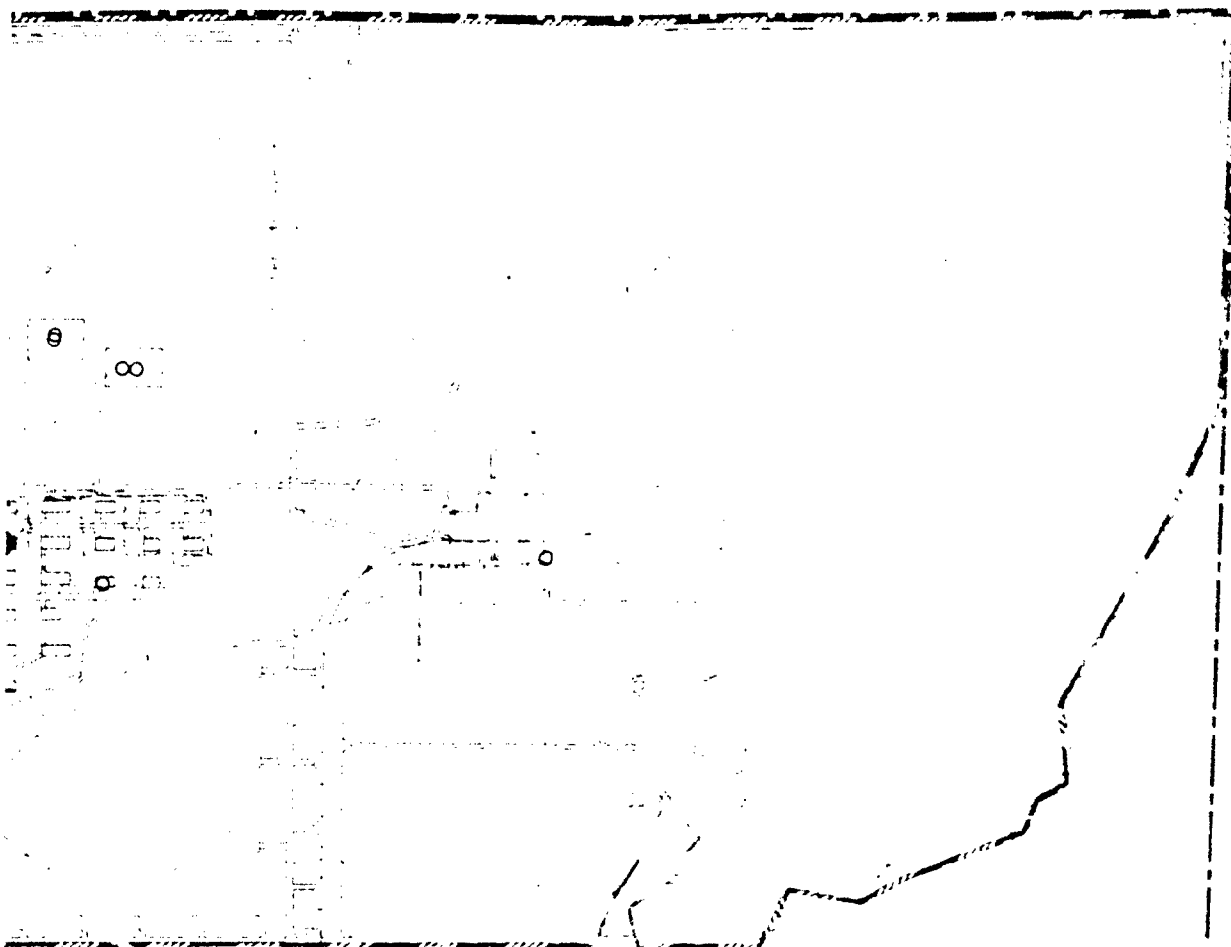
● 0.053 - 1.0

● > 1.0 - 10

● > 10 - 100

● > 100

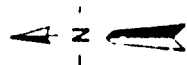




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL

23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42

1/4 MILES



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FIGURE ESA 21-13
Volatile Aromatic Organics in Soils in the
5-20 ft. Depth Interval

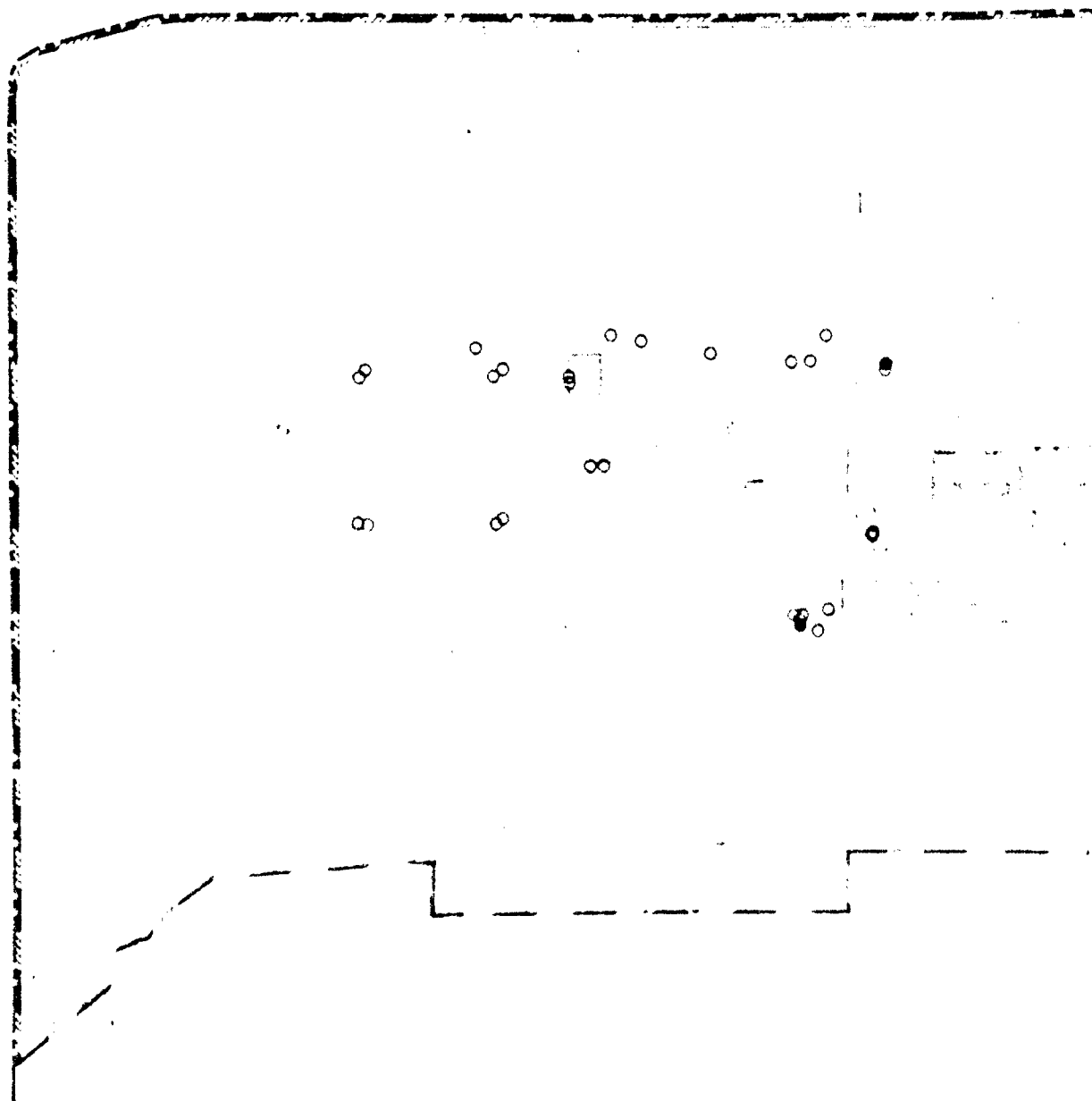
Rocky Mountain Arsenal
Prepared by Ebasco Services Incorporated

Legend

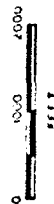
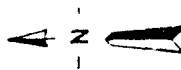
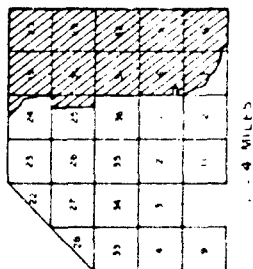
- Improved road
- Stream or ditch
- Railroad tracks
- Structure
- Eastern Study Area boundary
- State Plane grid
- Berms of soil mounds
- Unimproved road
- Shore line
- Section number
- Storage pits
- Arsenal boundary
- Fence
- USA-10
- Subarea boundary

ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

- Below Certified Reporting Limit (BCRL)
- 0.053-1.0
- > 1.0-10
- > 10-100
- > 100



EASTERN STUD. AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



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Rocky Mountain Arsenal Cleanup

FIGURE - ESA 2.1-14
Volatile Aromatic Organics in Soils in the
> 20 ft. Depth Interval

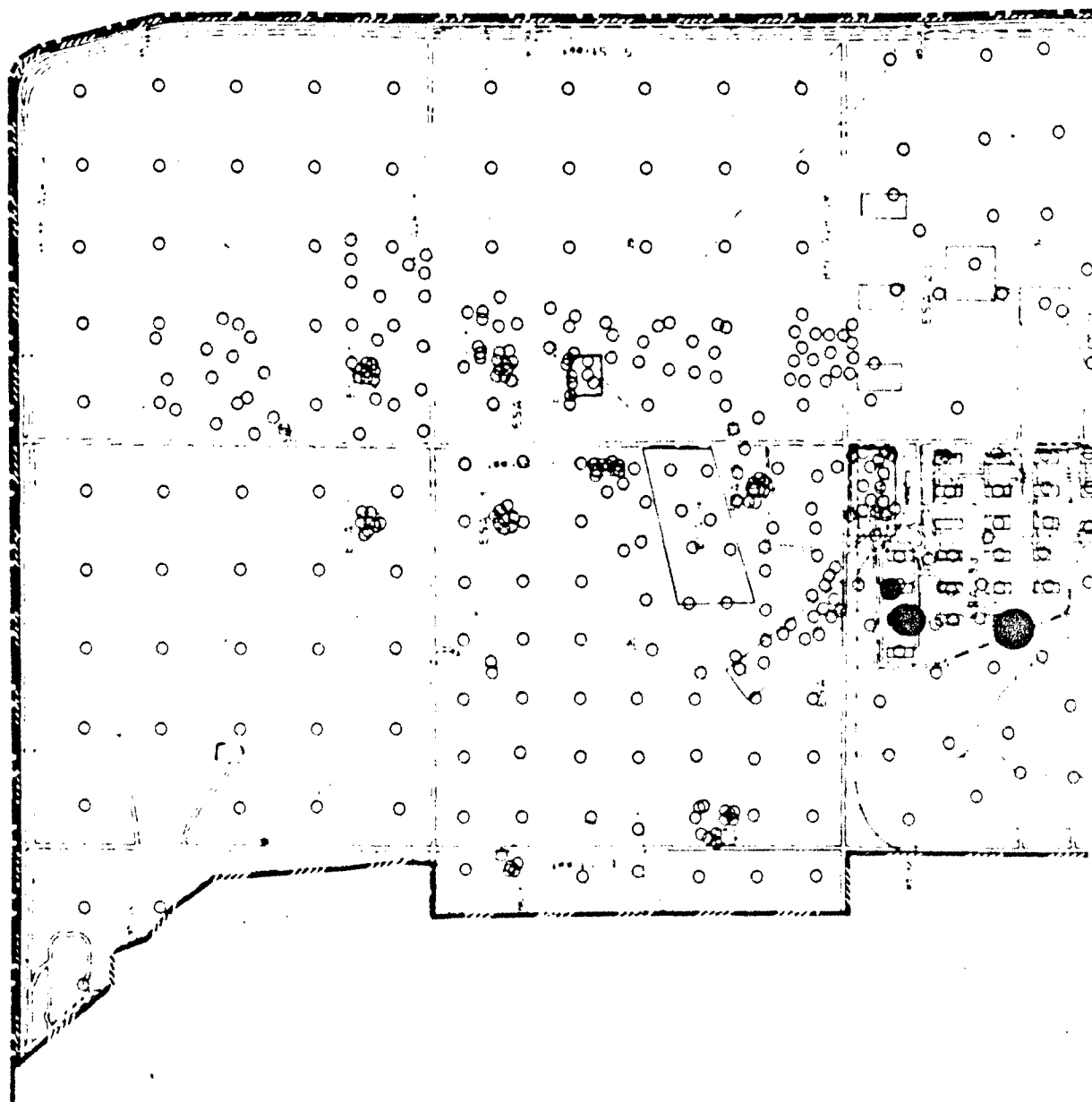
Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

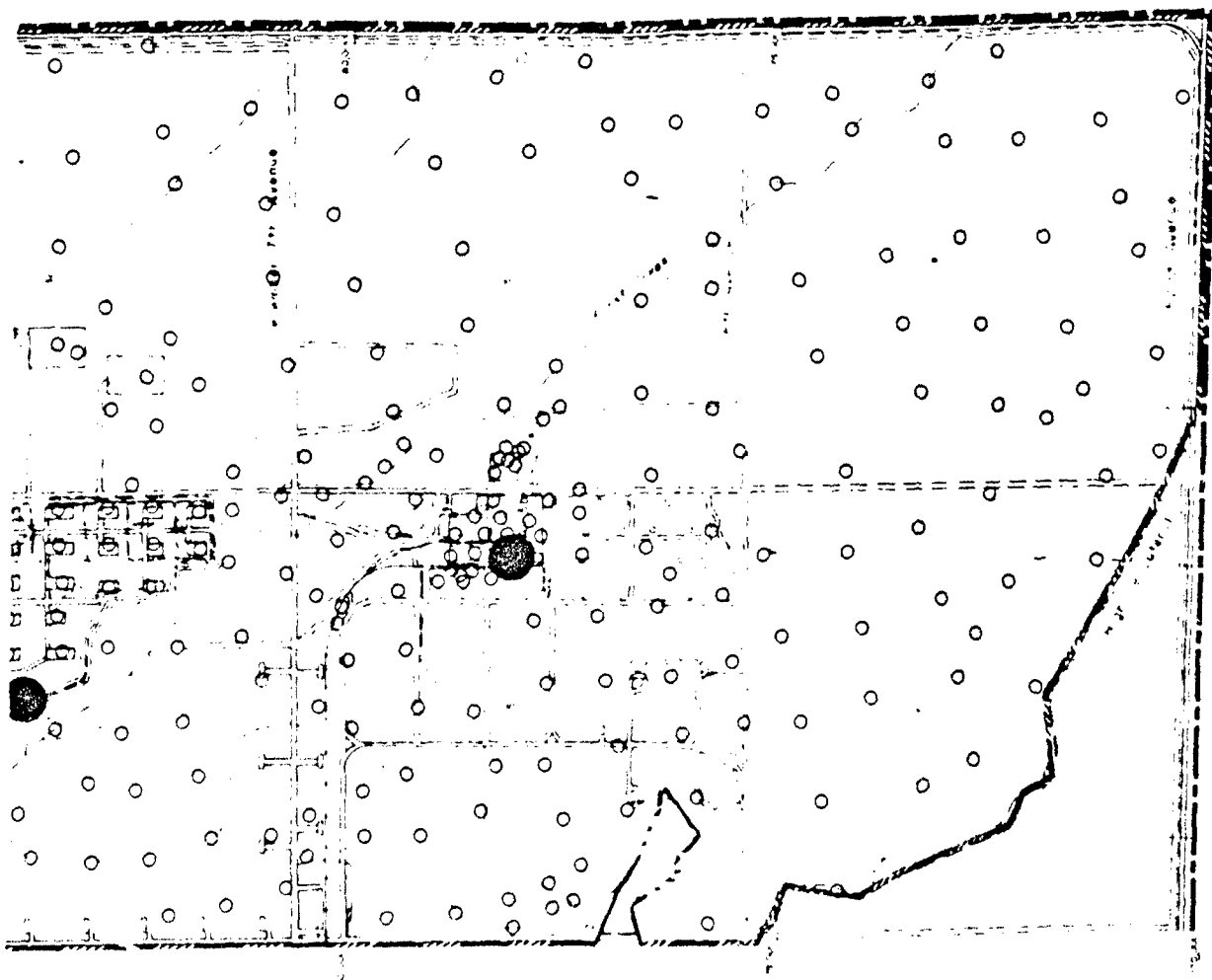
Legend

- == Improved road
- Unimproved road
- ~ Stream or ditch
- Shore line
- Railroad tracks
- 12 Section number
- Structure
- Storage ponds
- Eastern Study Area boundary
- State Plane grid
- Borne or anti mound
- ESA-10
- Subarea boundary

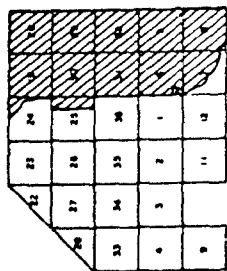
ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

- Below Certified Reporting Limit (BCRL)
- 0.30 - 1.0
- > 1.0 - 10
- > 10 - 100
- > 100

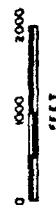
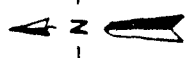




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1.4 MILES



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FIGURE ESA 2.1-15
Organosulfur Compounds, Mustard-Agent
Related in Soils in the 0-2 ft. Depth
Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

30-1

- Improved road
- Stream or ditch
- Railroad tracks
- Structure
- Eastern Study Area boundary
- State Plane grid
- Berms or soil mounds
- Unimproved road
- Shore line
- Seaplane number
- Storage pad
- Arsenal boundary
- Fence
- ESA-10
- Subarea boundary

ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

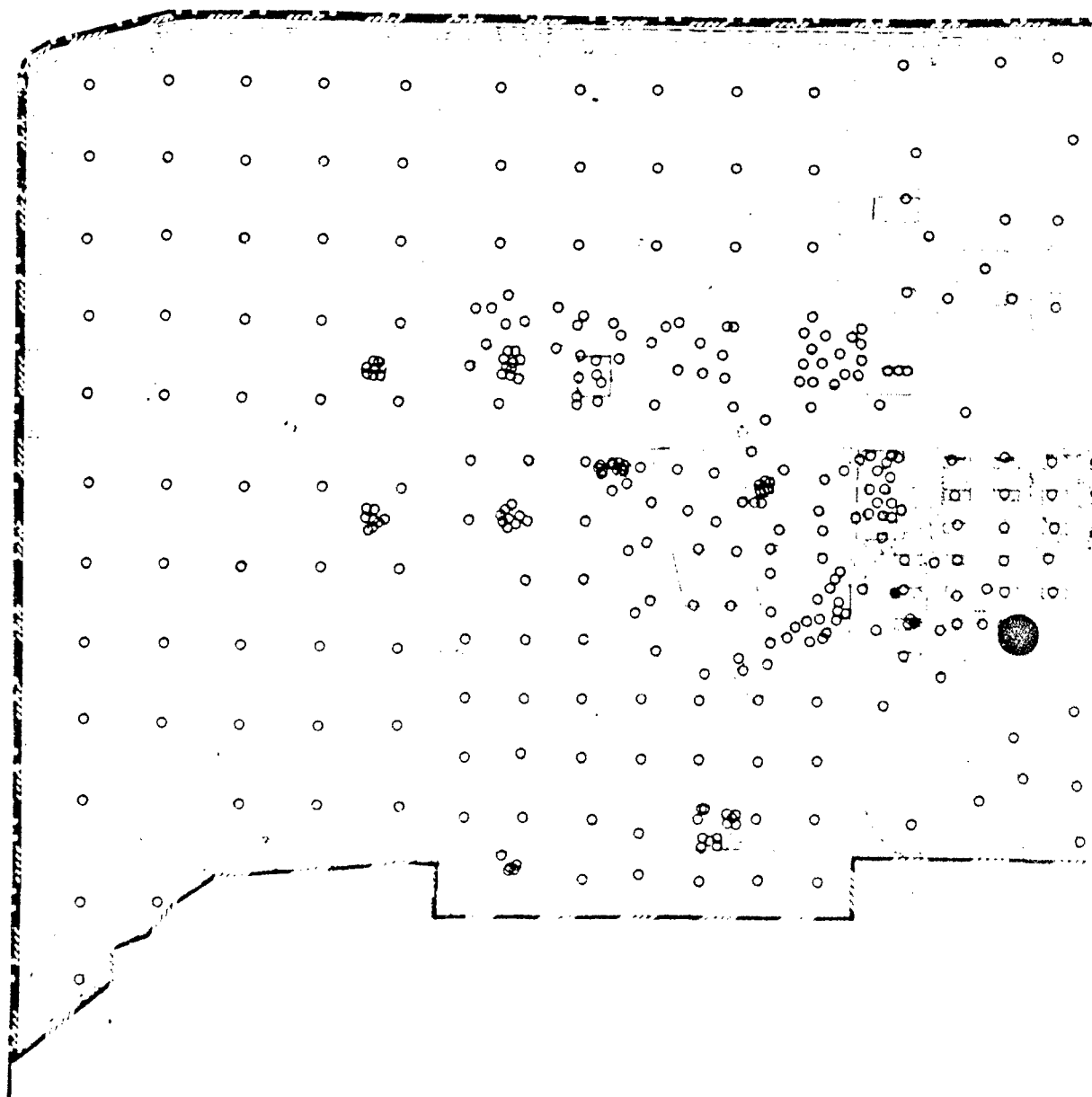
○ Below Certified Reporting Limit (BCRL)

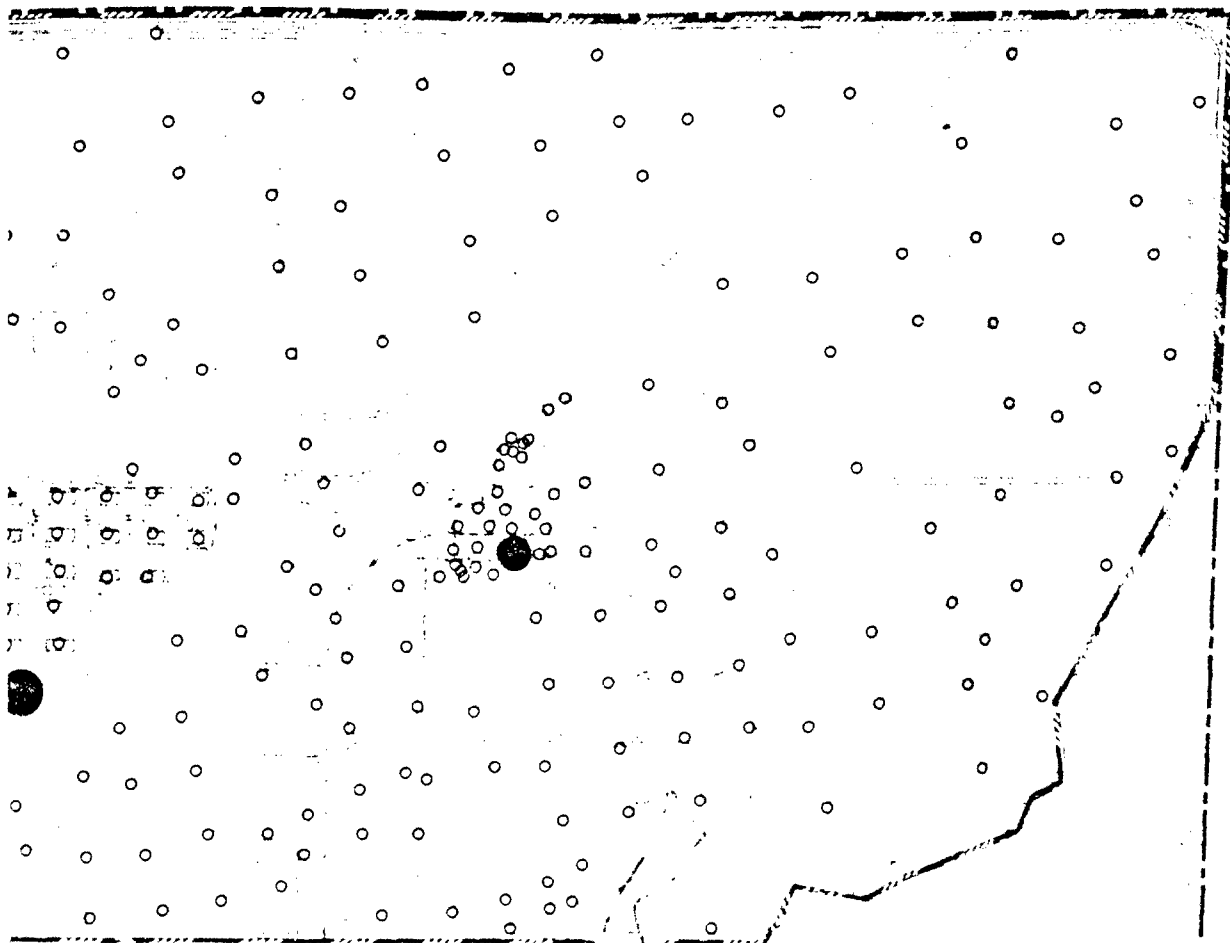
● 0.30 - 1.0

● > 1.0 - 10

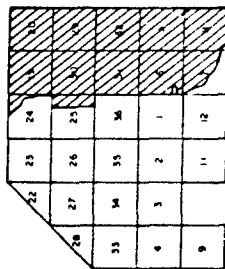
● > 10 - 100

● > 100

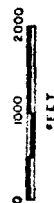
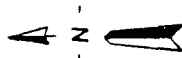




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



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Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE - ESA 2.1-16

Organosulfur Compounds, Mustard-Agent
Related in Soils in the 2-5 ft. Depth
Interval

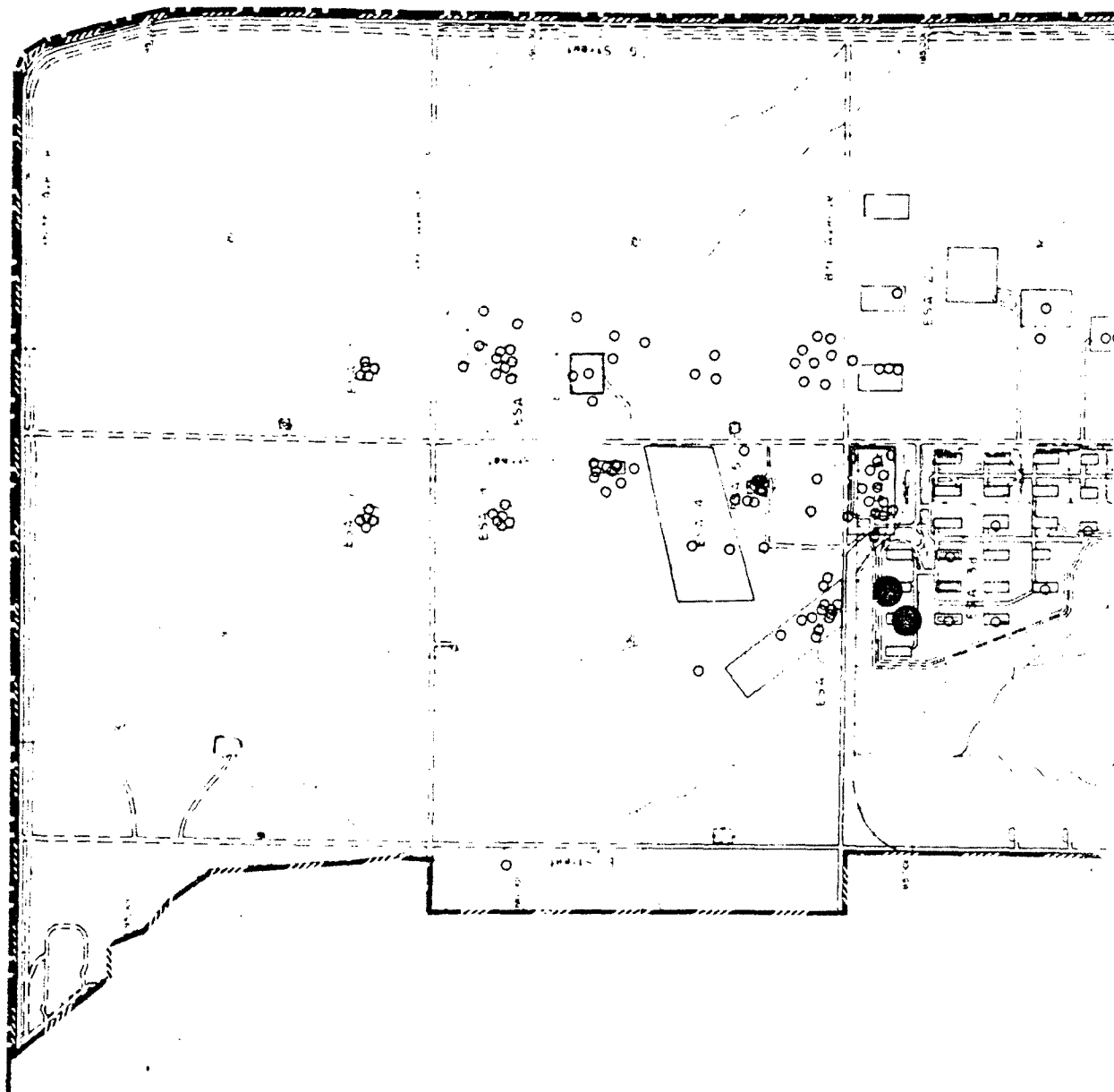
Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

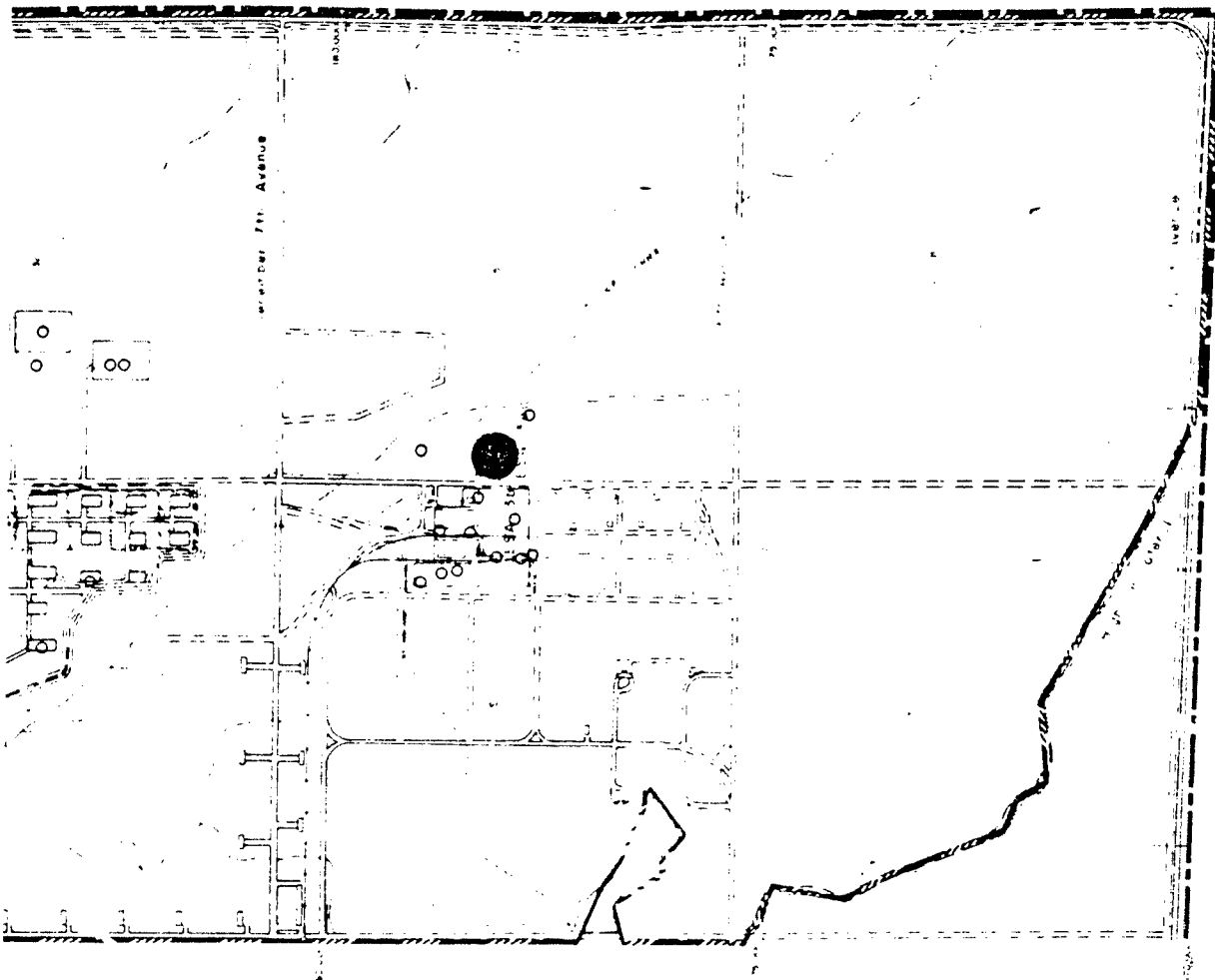
Legend

Improved road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Section number
Structure	Storage pods
Eastern Study Area boundary	Aerial boundary
State Plane grid	Fence
Berms or tail mounds	ESA-1a
	Subarea boundary

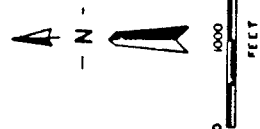
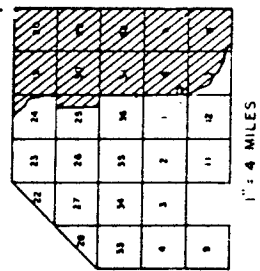
ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

Below Certified Reporting Limit (BCRL)
0.30 - 1.0
> 1.0 - 10
> 10 - 100
> 100





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL

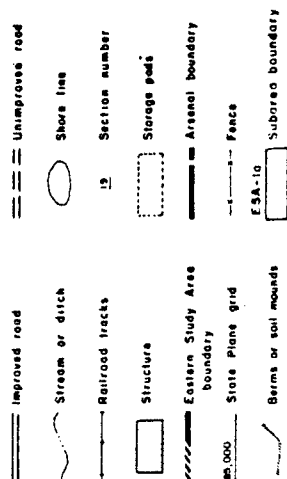


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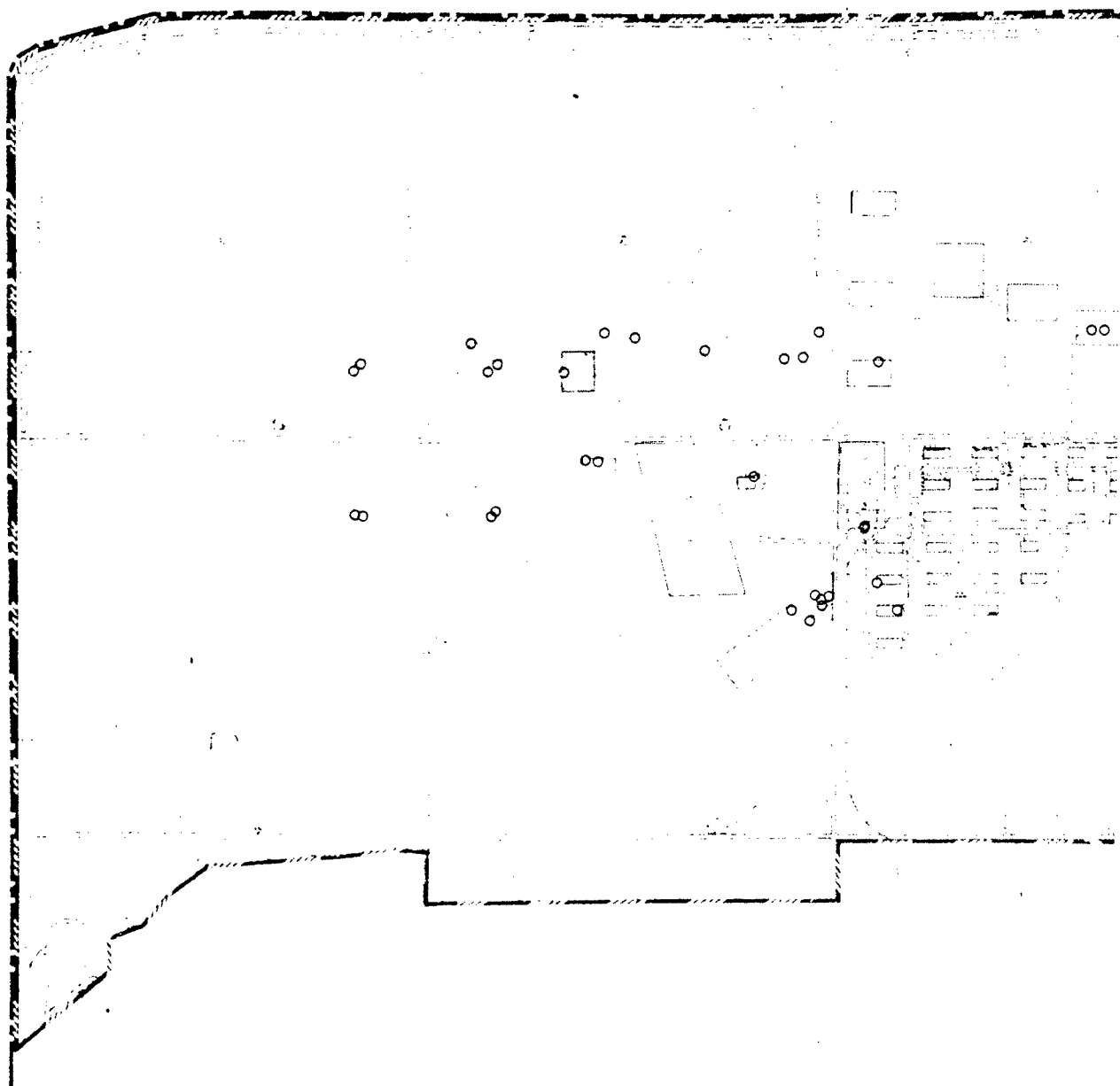
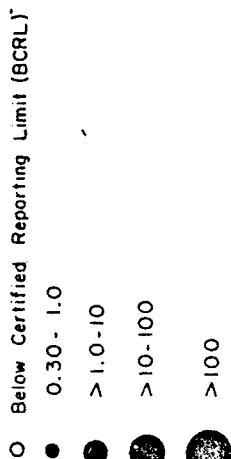
FIGURE ESA 2.1-17
Organosulfur Compounds, Mustard-Agent
Related in Soils in the 5-20 ft. Depth
Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

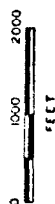
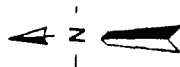
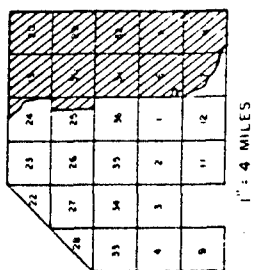
Legend



ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/g)



EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

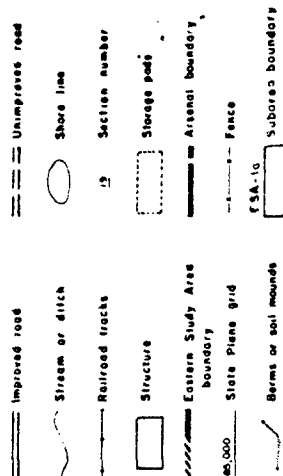
FIGURE · ESA 2.1-18

Organosulfur Compounds, Mustard-Agent
Related in Soils in the > 20 ft. Depth
Interval

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

Legend



ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

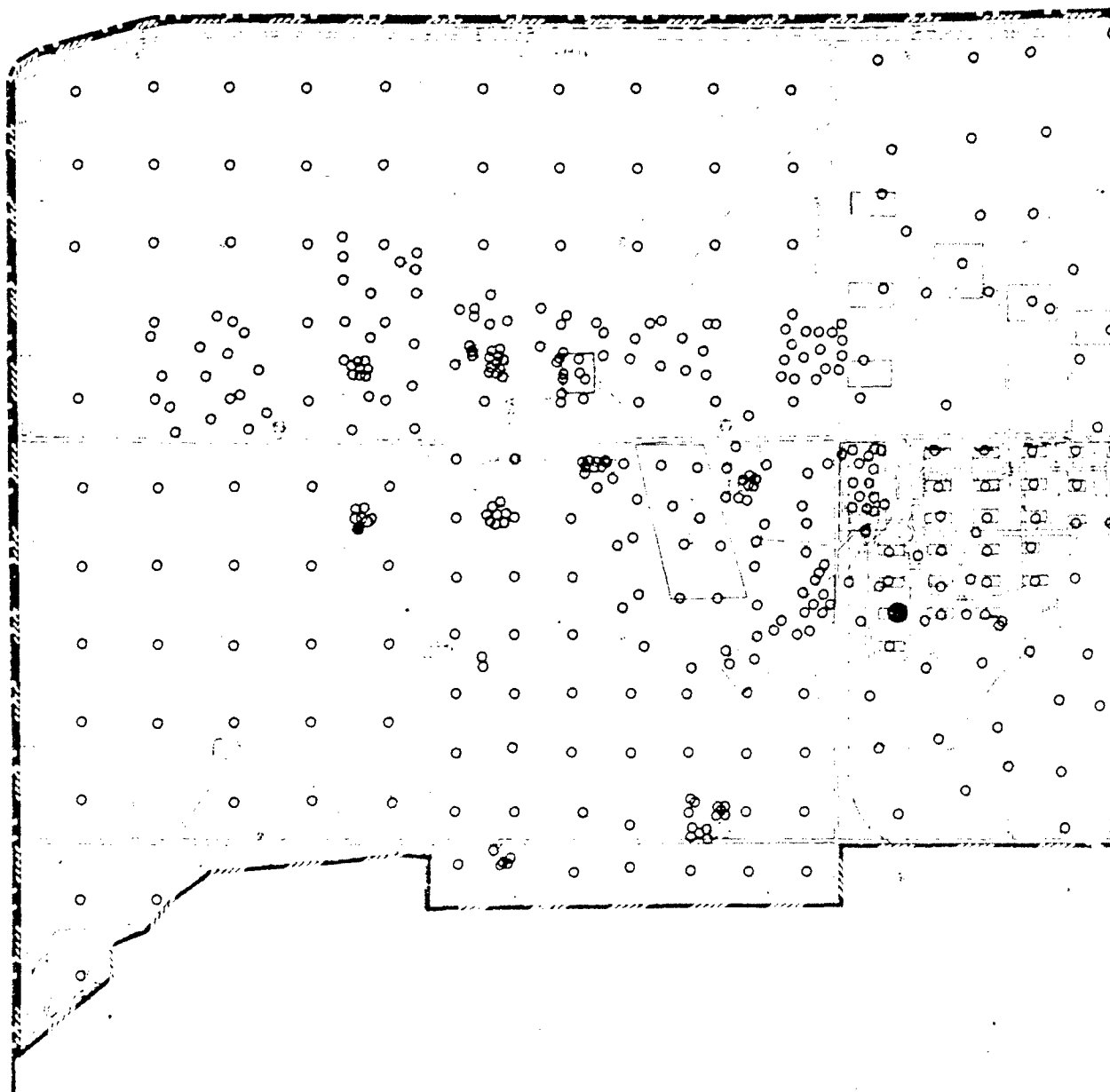
Below Certified Reporting Limit (BCRL)

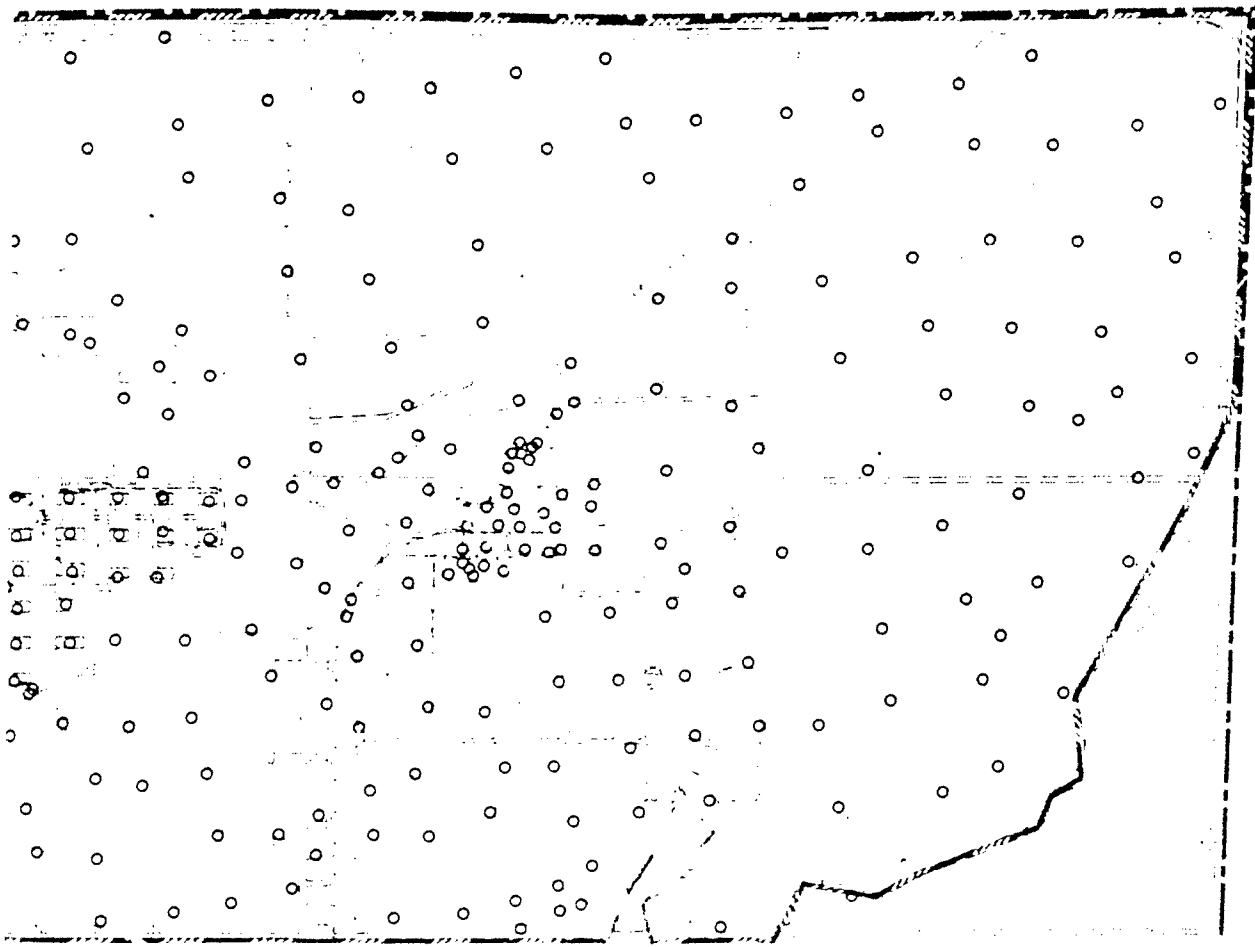
0.30 - 1.0

> 1.0 - 10

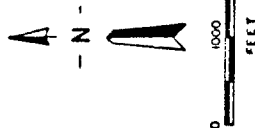
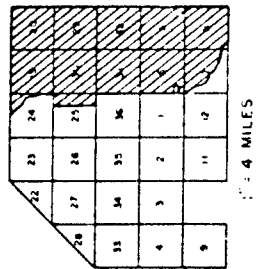
> 10 - 100

> 100





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL

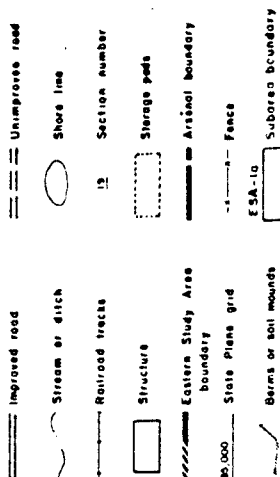


Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

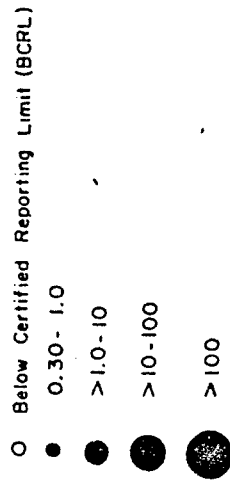
FIGURE - ESA 2.1-19
Organosulfur Compounds, Herbicide
Related in Soils in the 0-2 ft.
Depth Interval

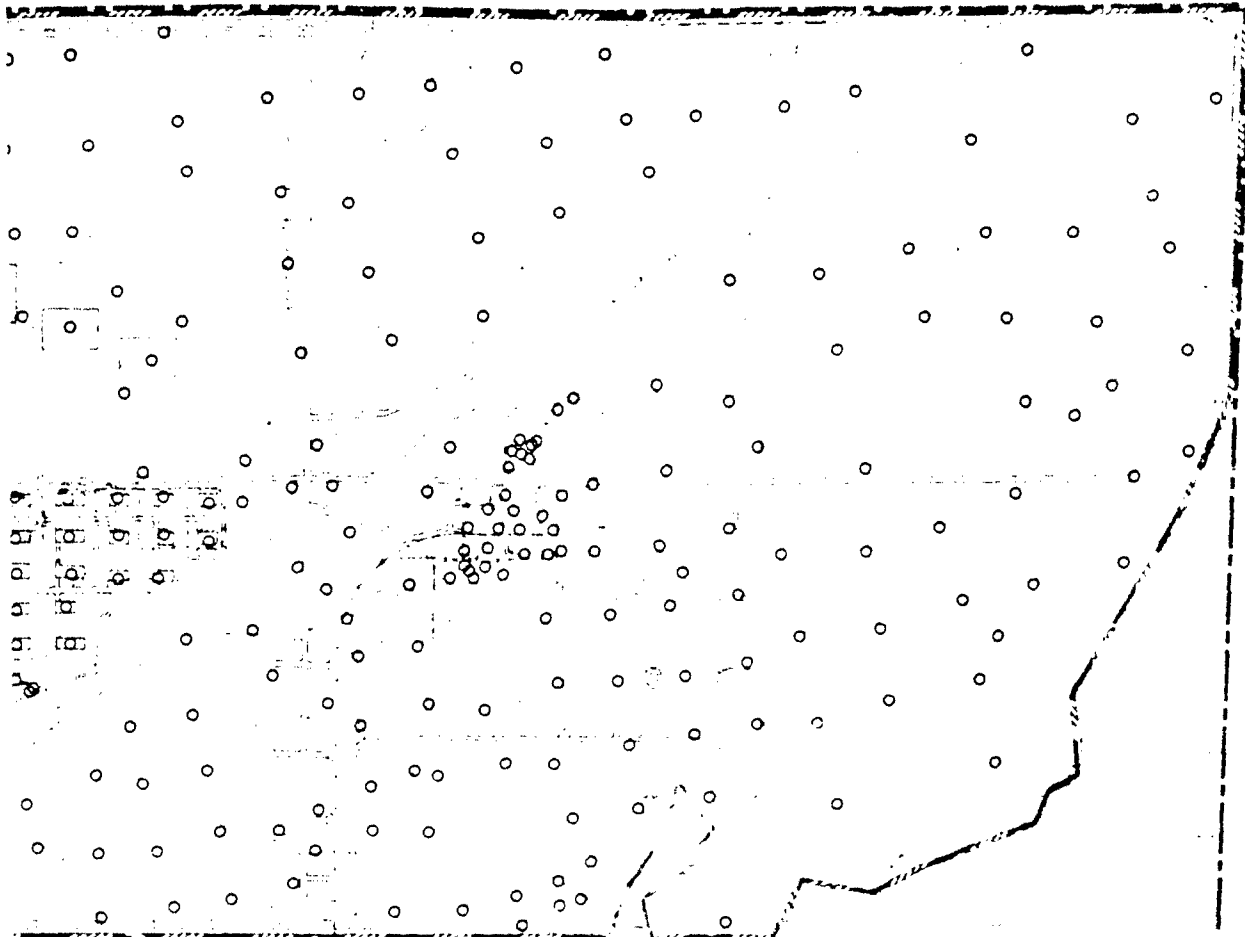
Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

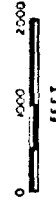
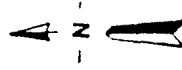
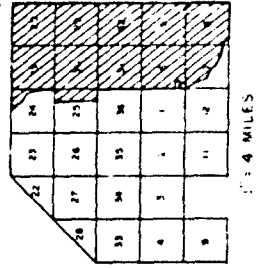


ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/g)





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



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FIGURE ESA 2.1-20
Organosulfur Compounds, Herbicide
Related in Soils in the 2-5 ft.
Depth Interval

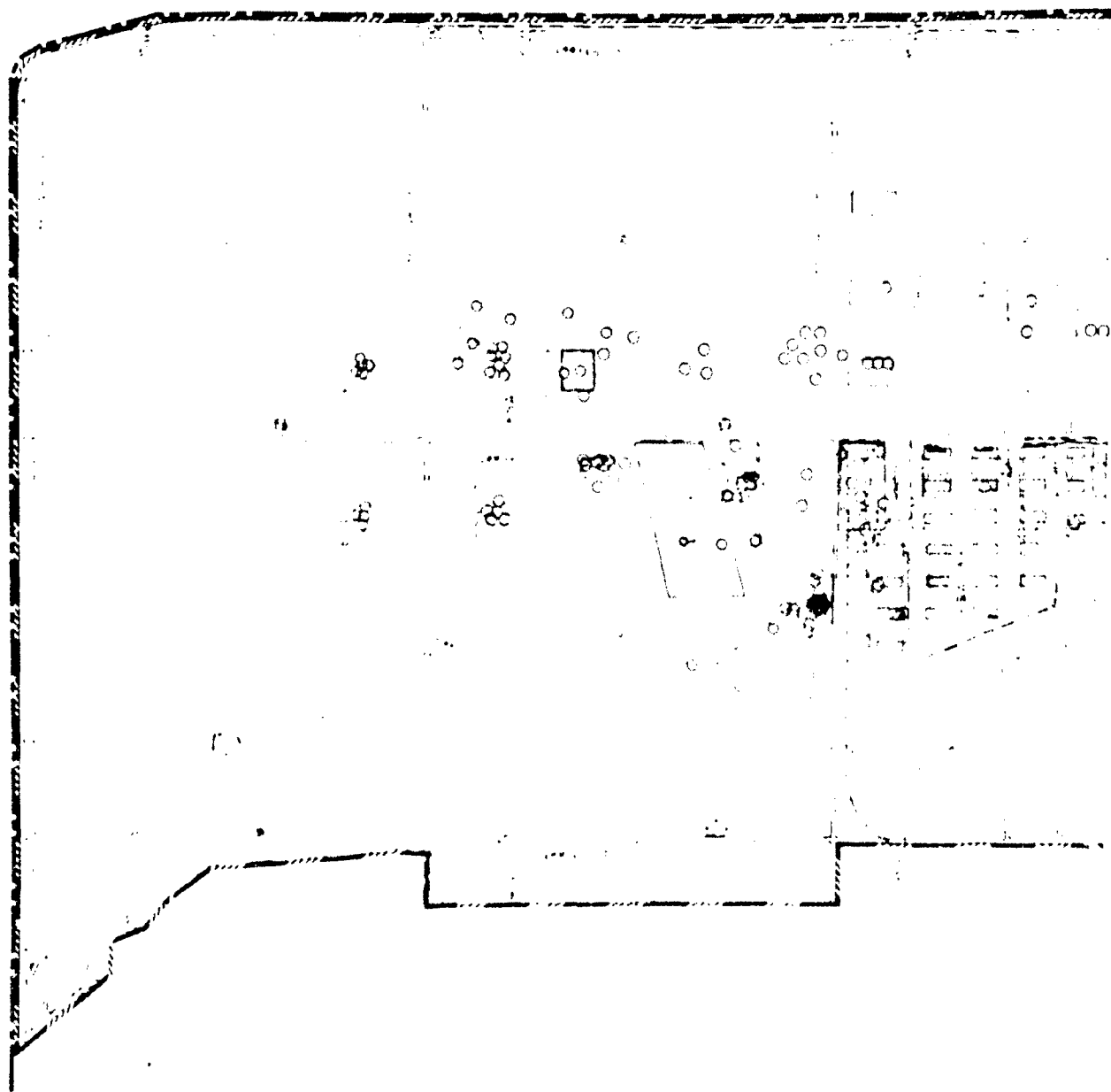
Rocky Mountain Arsenal
Prepared by: Eastern Research Laboratories

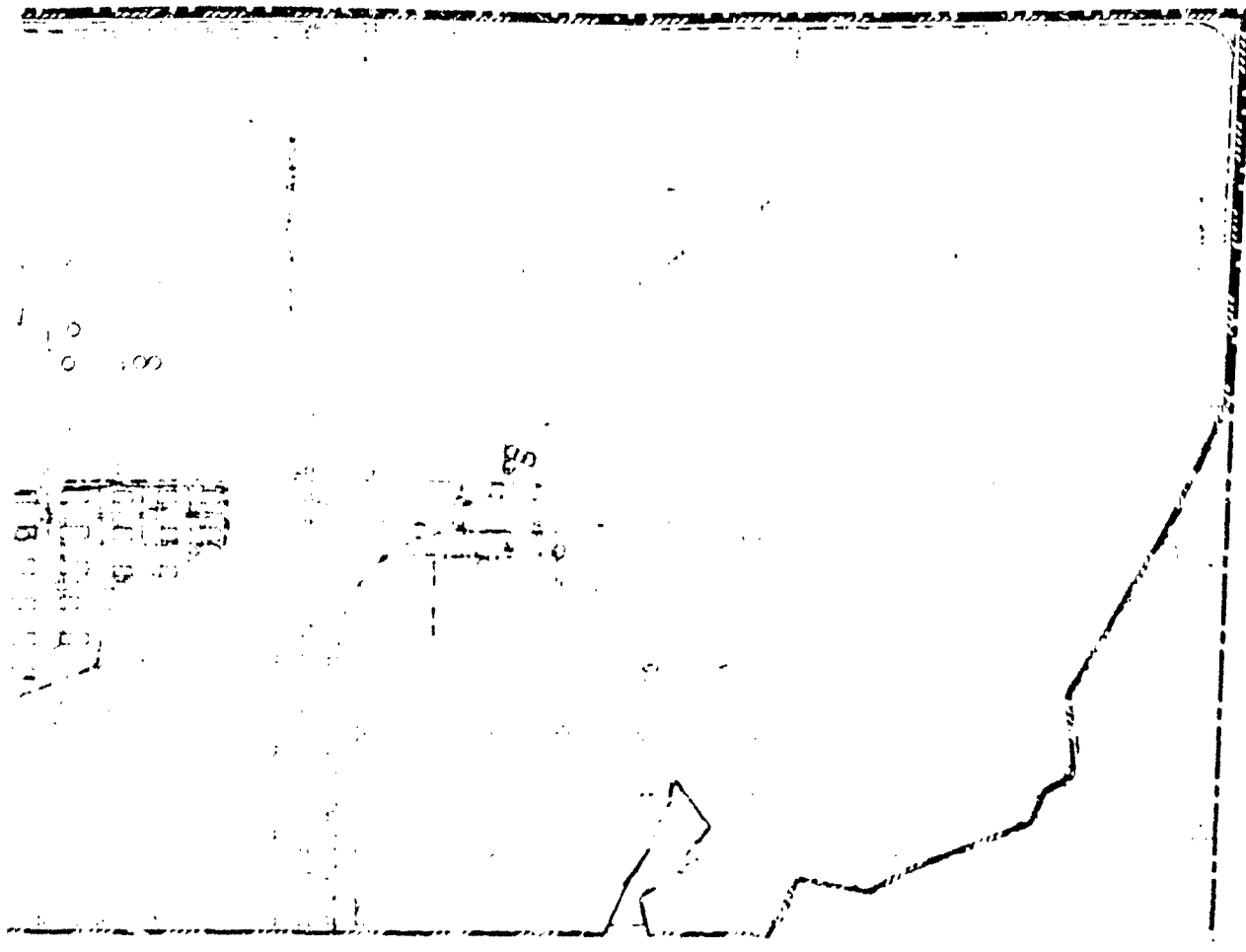
Legend

Impressed road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Section number
Structure	Storage pads
Eastern Study Area boundary	Armed Forces boundary
State Plane Grid	Fence
Barms or soil mounds	ESR-10
	Subarea boundary

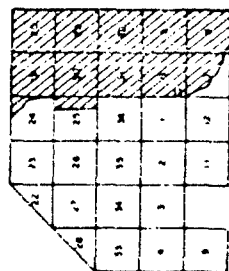
ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

○	Below Certified Reporting Limit (BCRL)
●	0.30 - 1.0
●	> 1.0 - 10
●	> 10 - 100
●	> 100

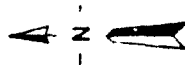




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1/4 MILES



Prepared for:

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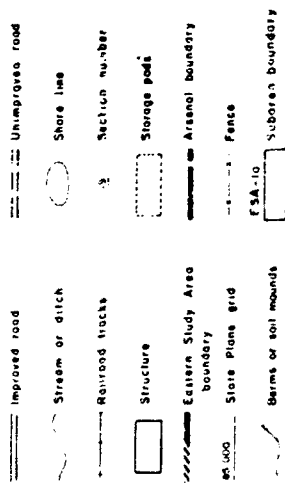
FIGURE ESA 2.1-21

Organosulfur Compounds, Herbicide
Related in Soils in the 5-20 ft.
Depth Interval

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

Legend



ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/g)

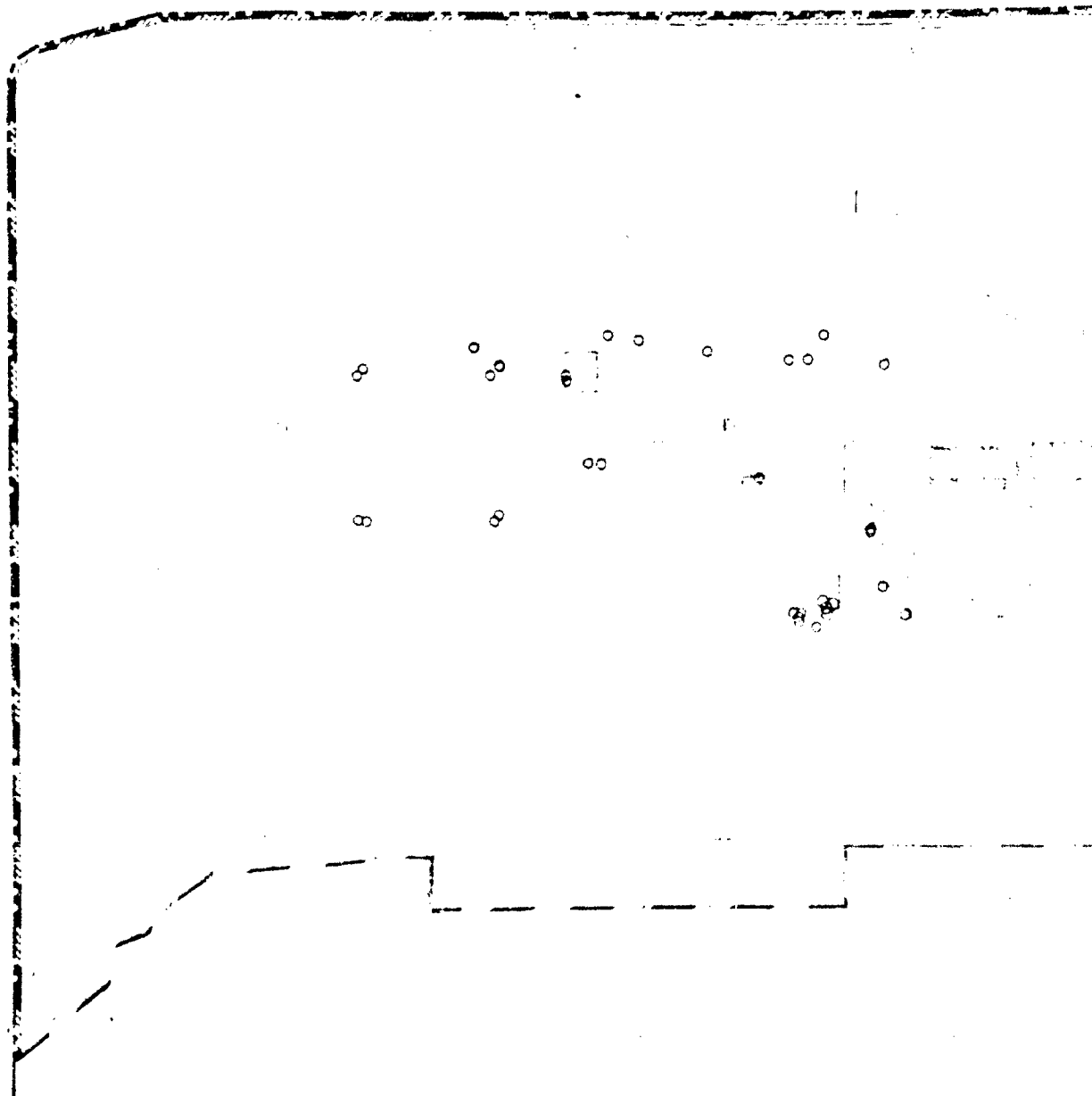
○ Below Certified Reporting Limit (BCRL)

● 0.30 - 1.0

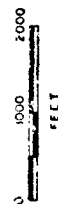
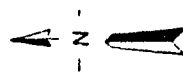
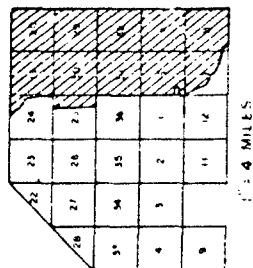
● > 1.0 - 10

● > 10 - 100

● > 100



EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



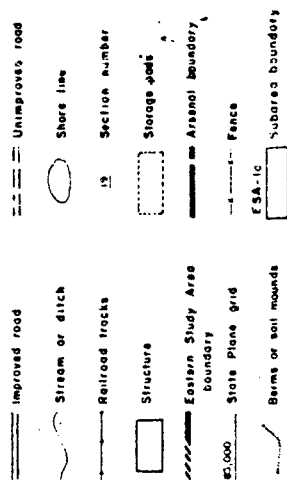
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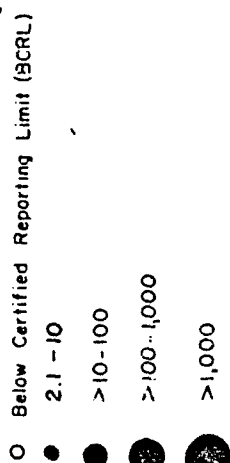
FIGURE - ESA 2.1-22
Organosulfur Compounds, Herbicide
Related in Soils in the > 20 ft.
Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

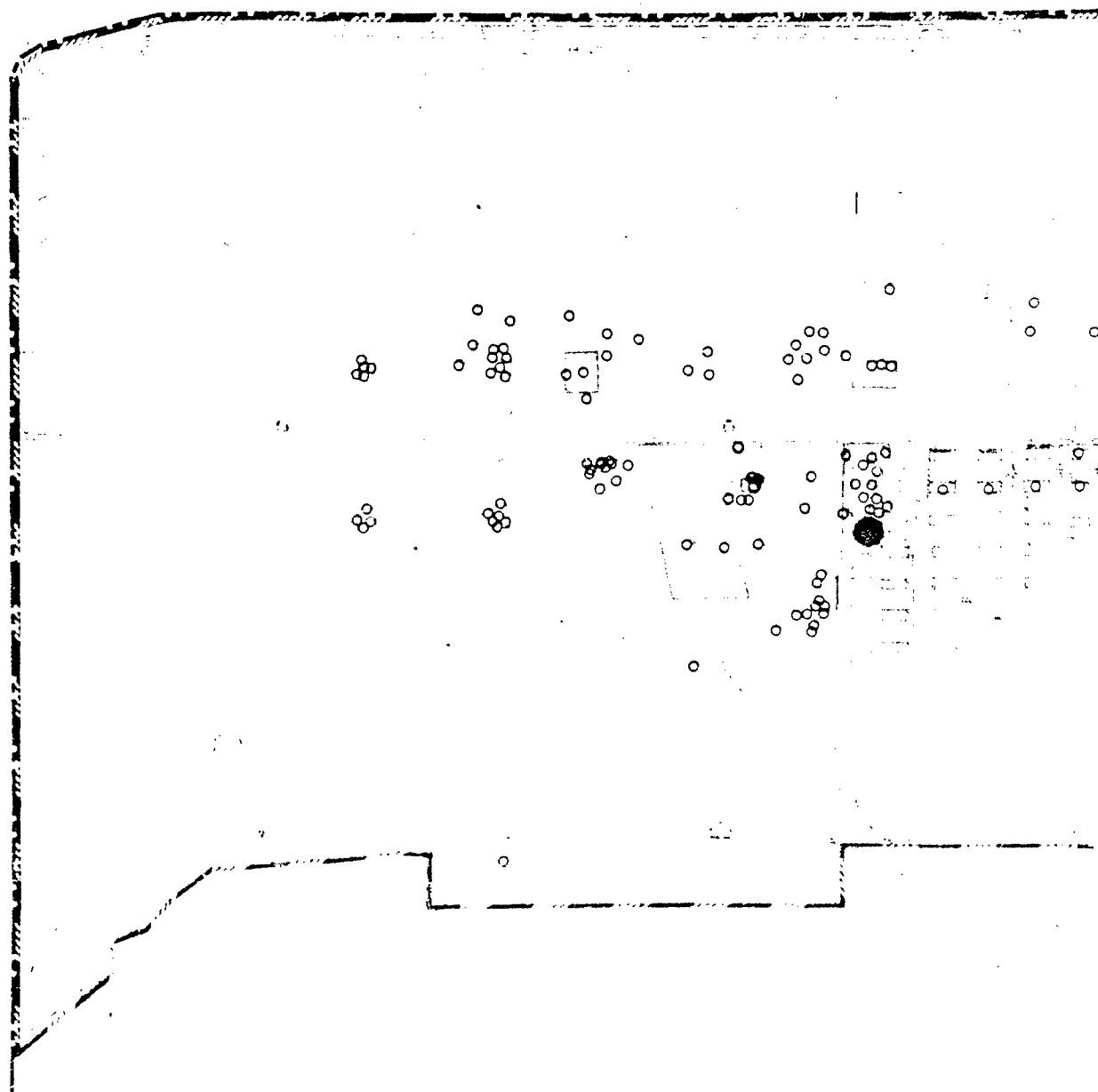
Legend



ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

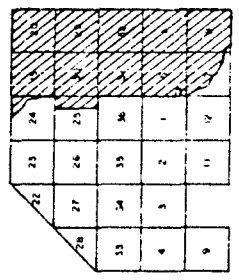


* The only member of the Organophosphorous Compounds, GB-Agent Related group detected in ESA soils analysis.

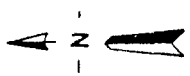




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



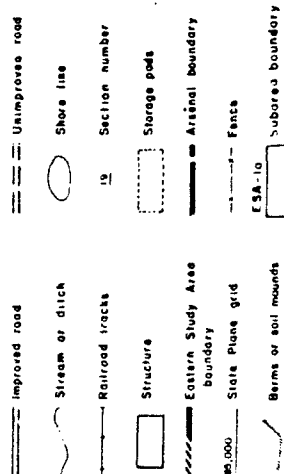
Prepared for:

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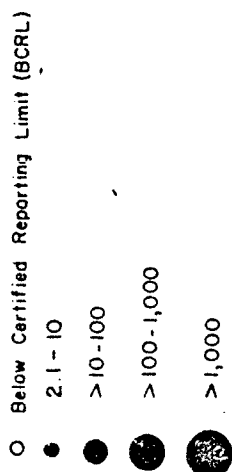
FIGURE . ESA 2.1-23
Isopropylmethylphosphonic Acid in Soils
in the 5-20 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

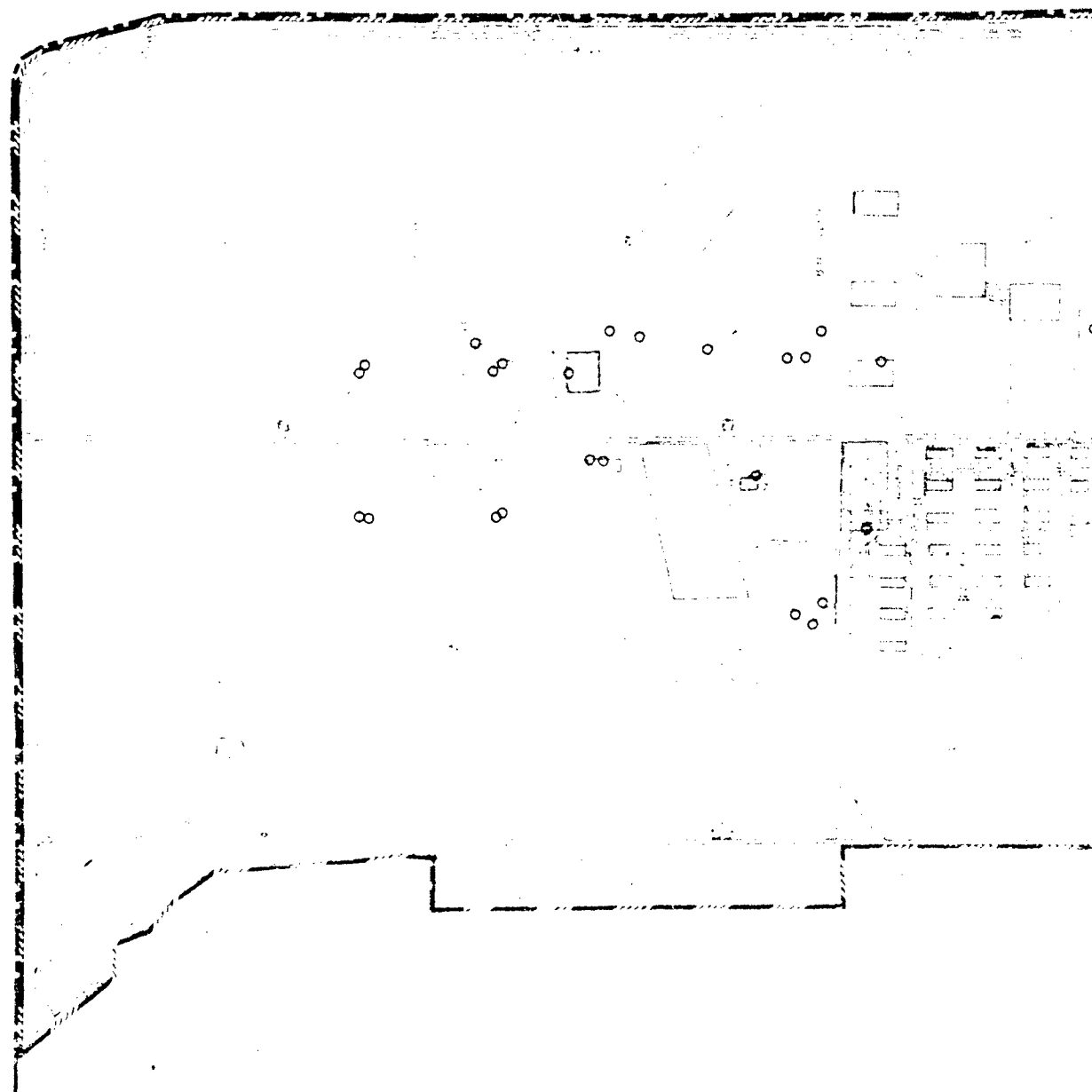
Legend

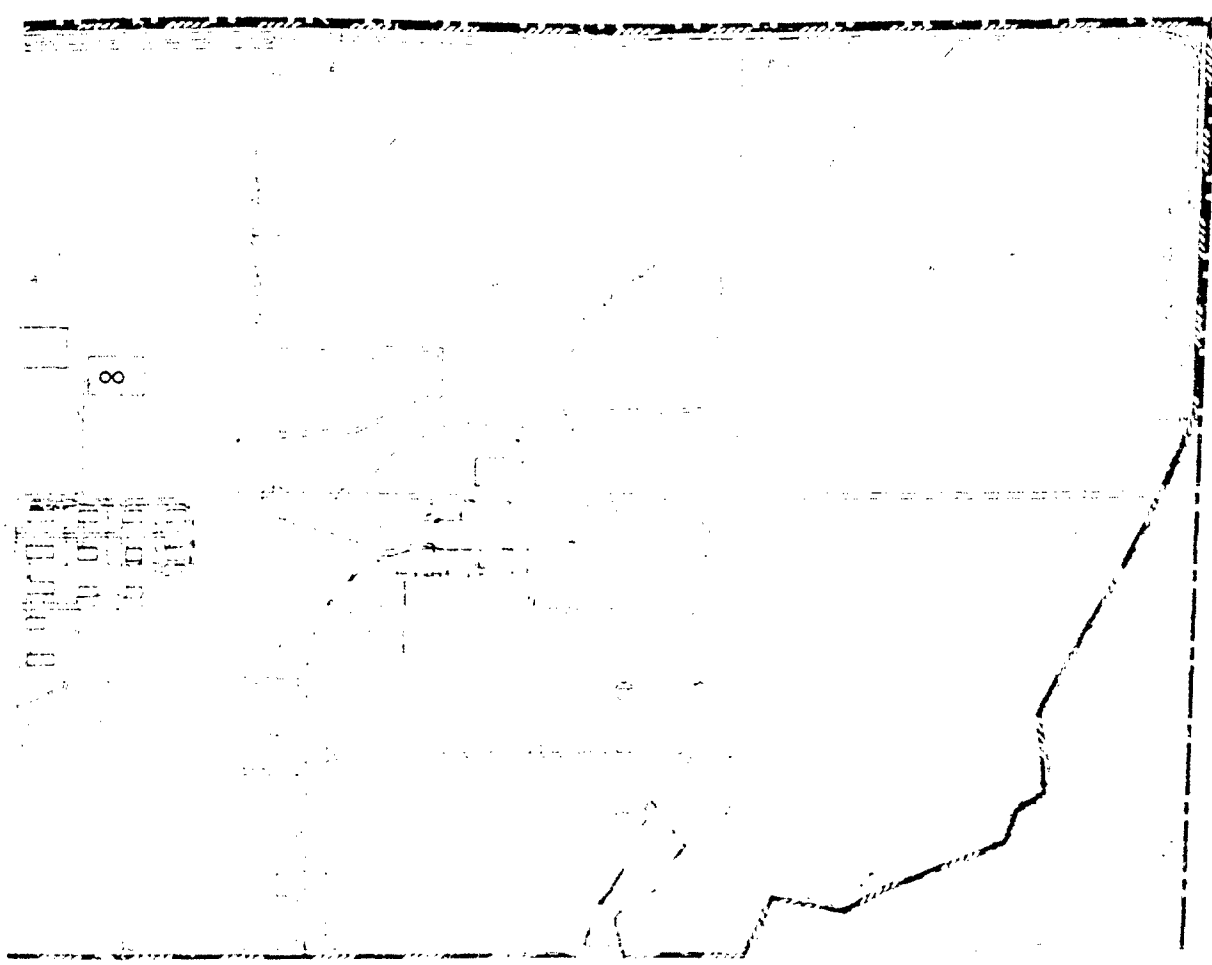


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

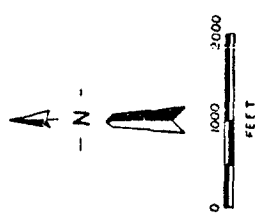
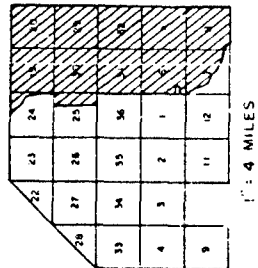


The only member of the Organophosphorous Compounds, GB-Agent Related group detected in ESA soils analysis.





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL

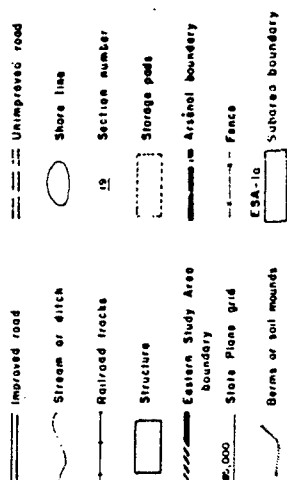


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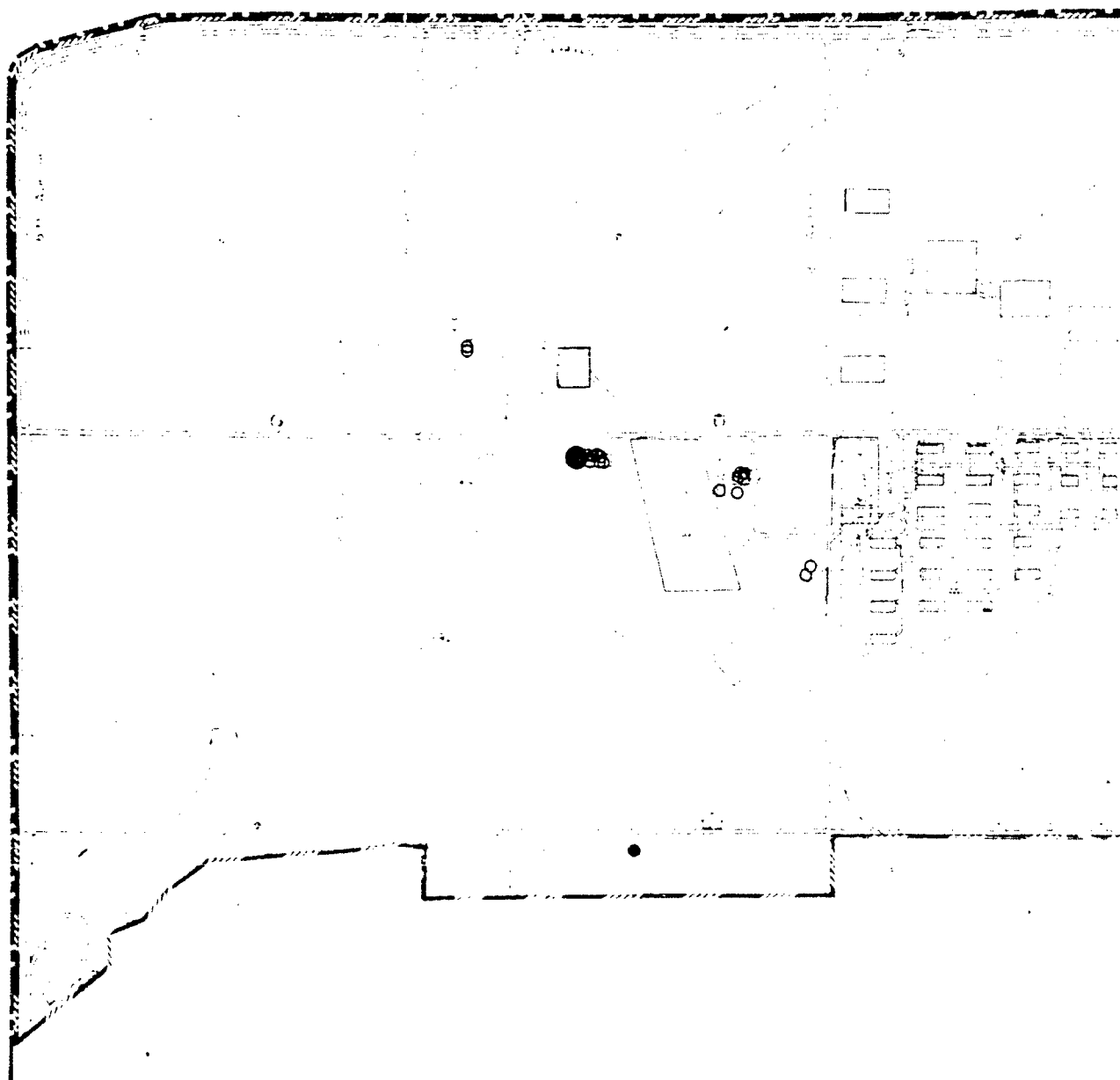
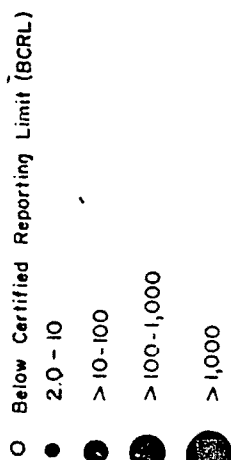
FIGURE ESA 2.1-24
Isopropylmethylphosphonic Acid* in Soils
in the >20 ft. Depth Interval

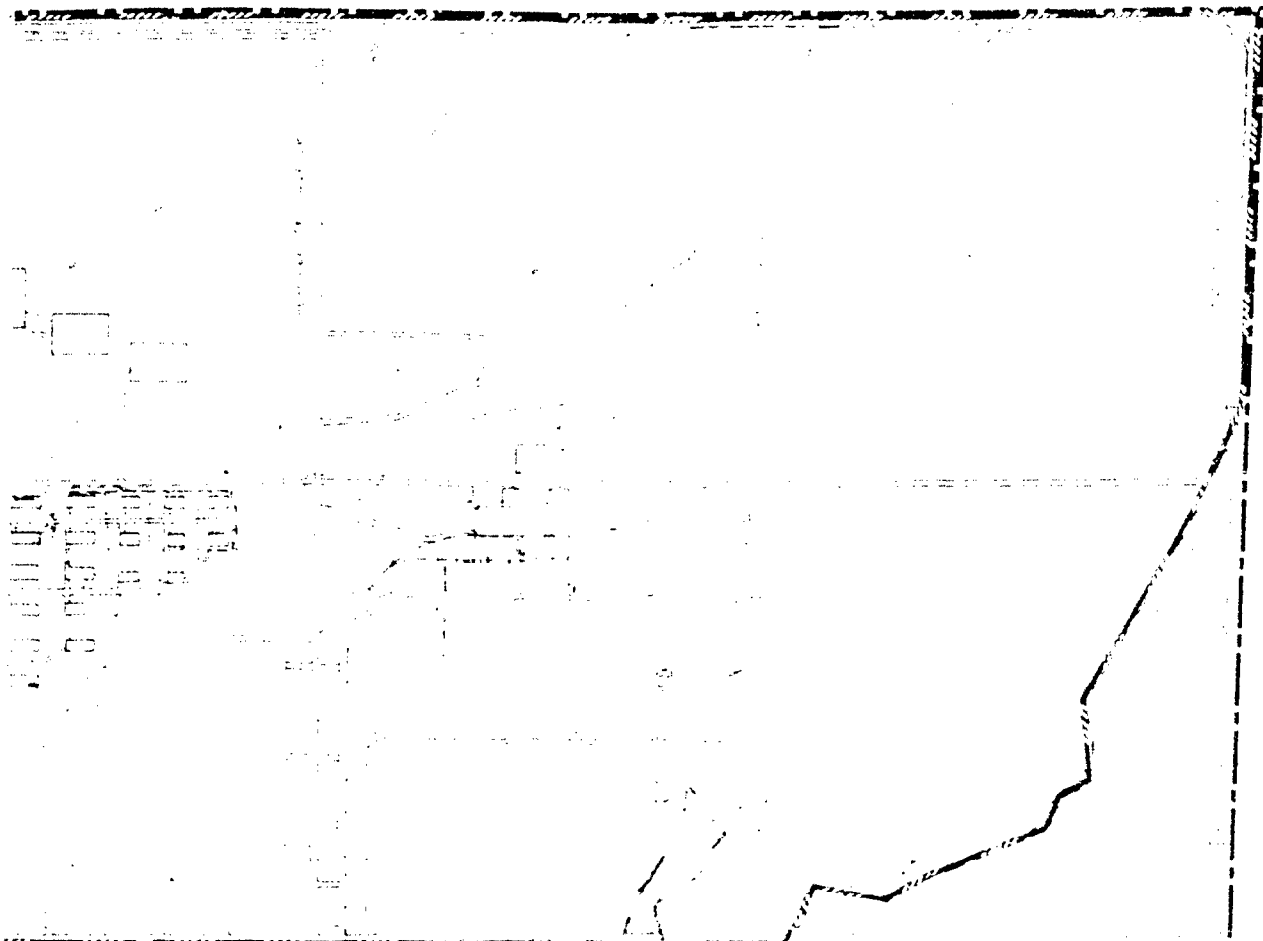
Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

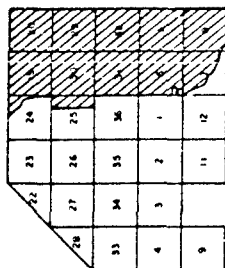


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

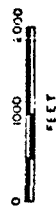
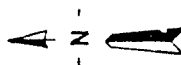




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1/4 MILES



Prepared for:

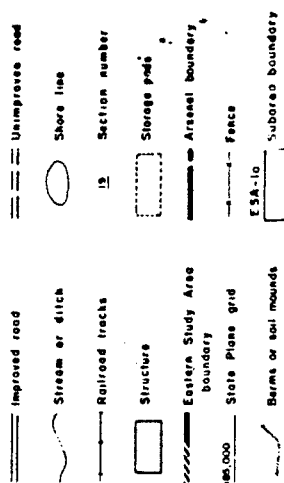
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Rocky Mountain Arsenal Cleanup

FIGURE ESA 2J-25

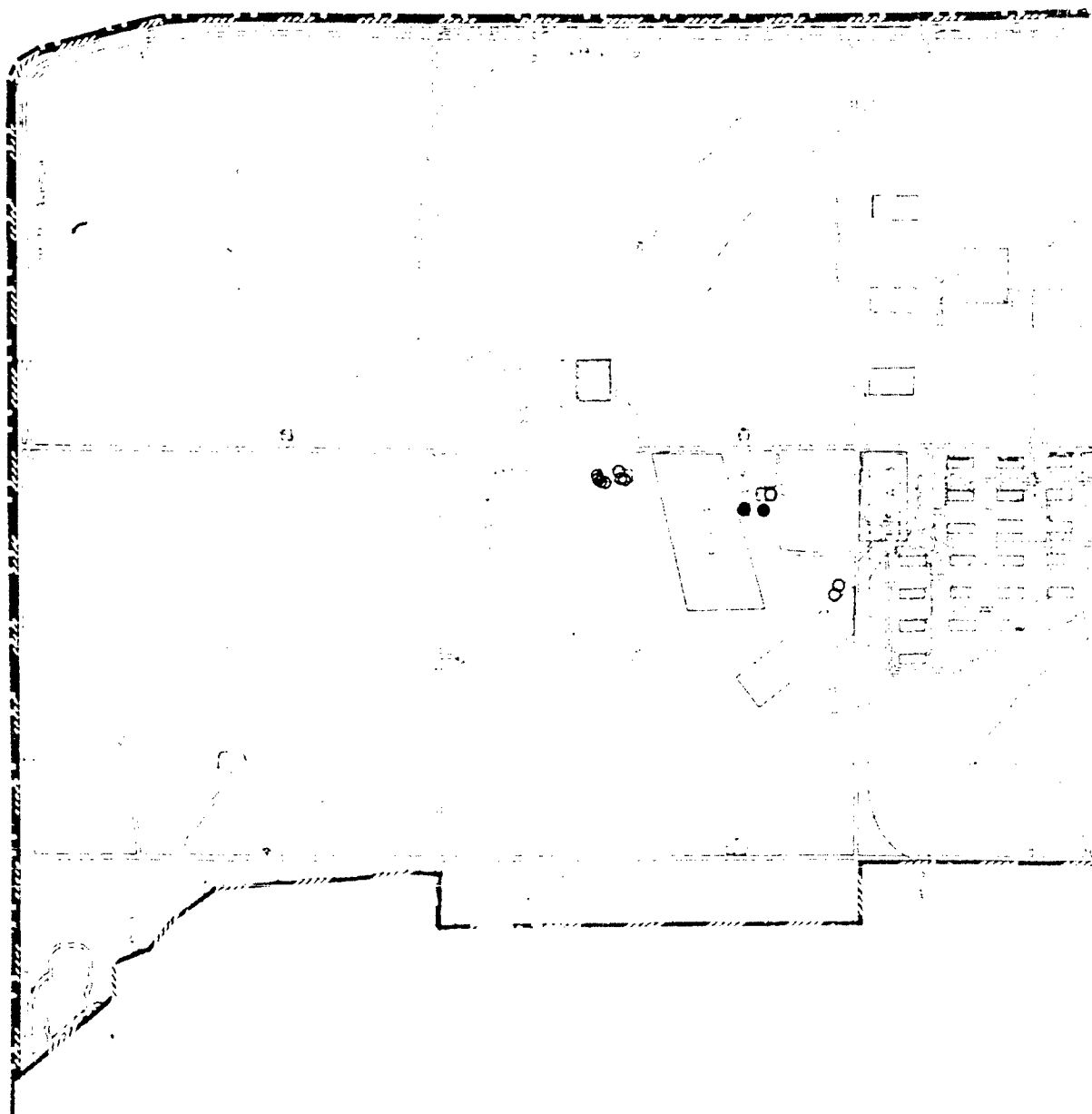
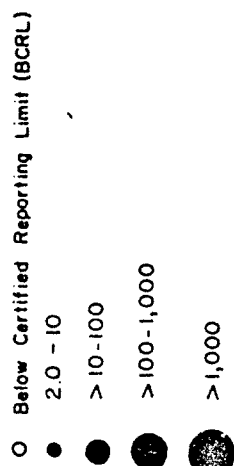
Fluoroacetic Acid in Soils in the
0-2 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

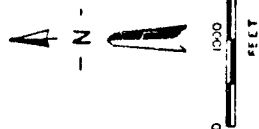
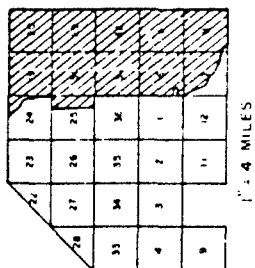


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



Prepared for:










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Rocky Mountain Arsenal Cleanup

FIGURE -ESA 2J-26

Fluoroacetic Acid in Soils in the
2-5 ft. Depth Interval

Rocky Mountain Arsenal

Legend

 Unpaved road
 Stream or ditch
 Railroad tracks
 Structure
 Station stop
 Aerial boundary
 Fence
 USA
 Boundary

ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/g)

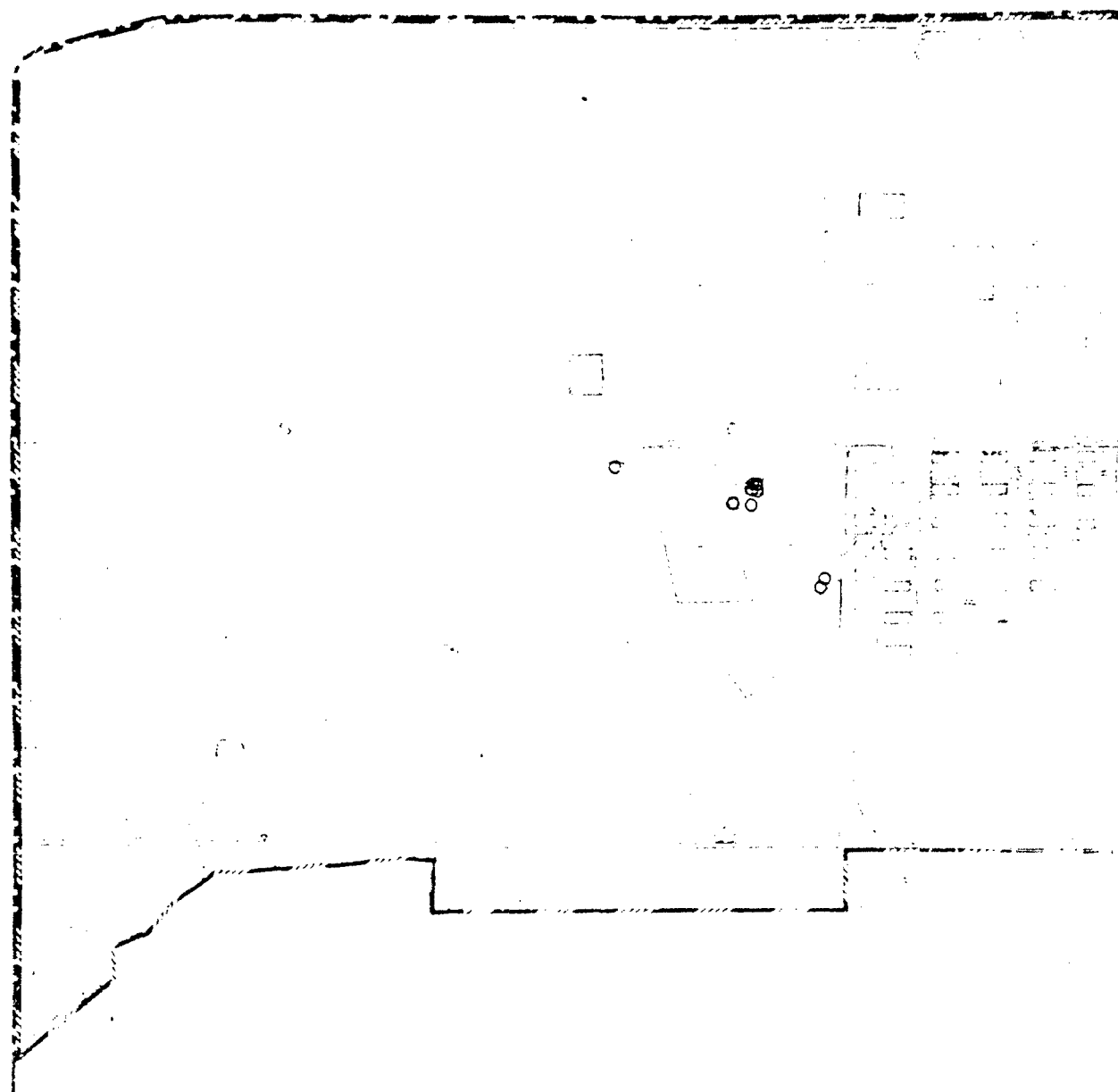
☐ Below Certified Reporting Limit (BCRL)

20-10

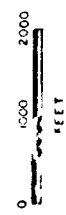
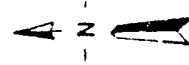
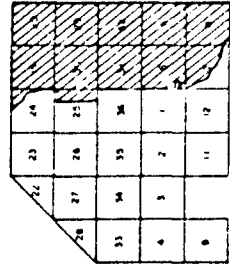
10-100

200-1,000

1,000



EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



Prepared for:

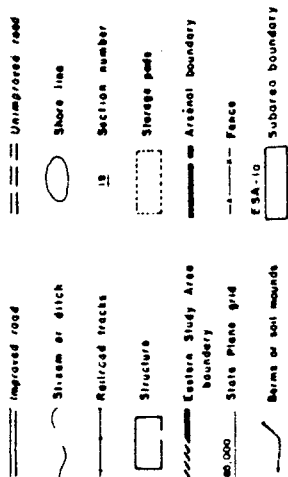
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE - ESA 2J-27

Fluoroacetic Acid in Soils in the
5-20 ft. Depth Interval

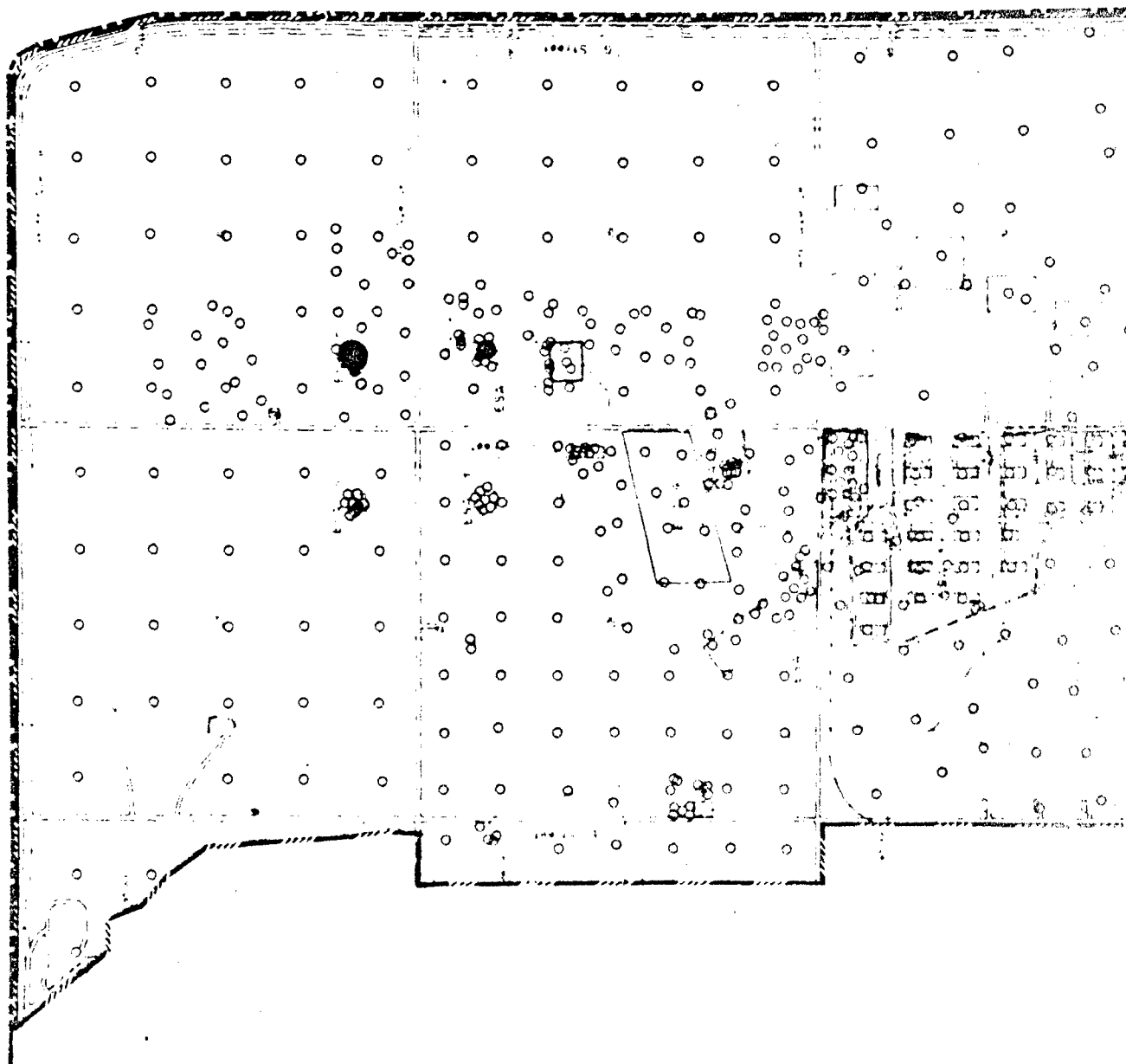
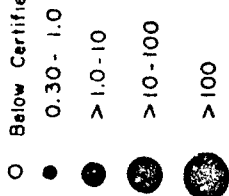
Rocky Mountain Arsenal

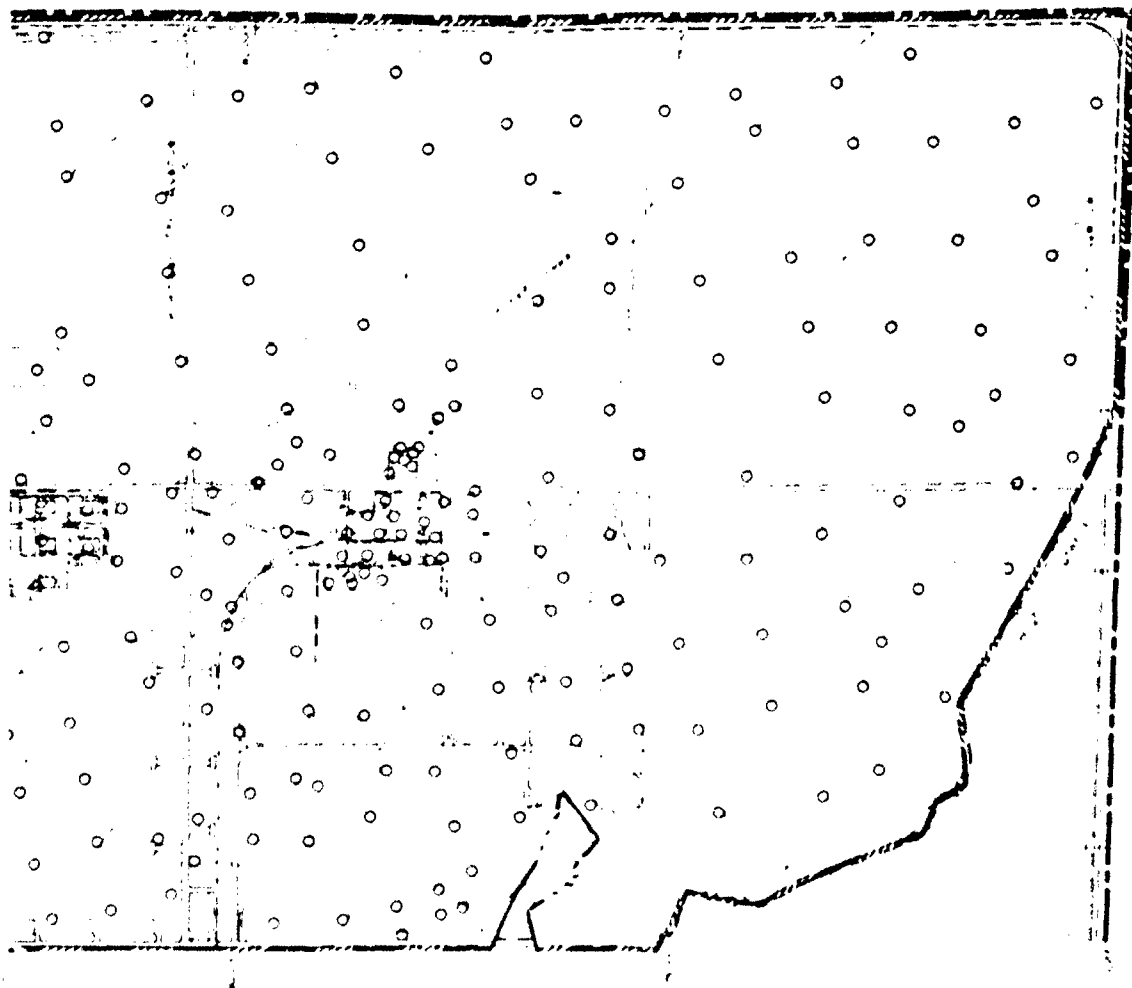
Prepared by: Ebasco Services Incorporated



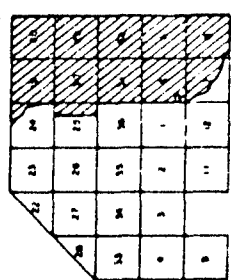
ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/g)

Below Certified Reporting Limit (BCRL)

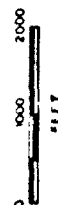
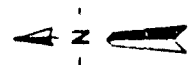




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1:4 MILES



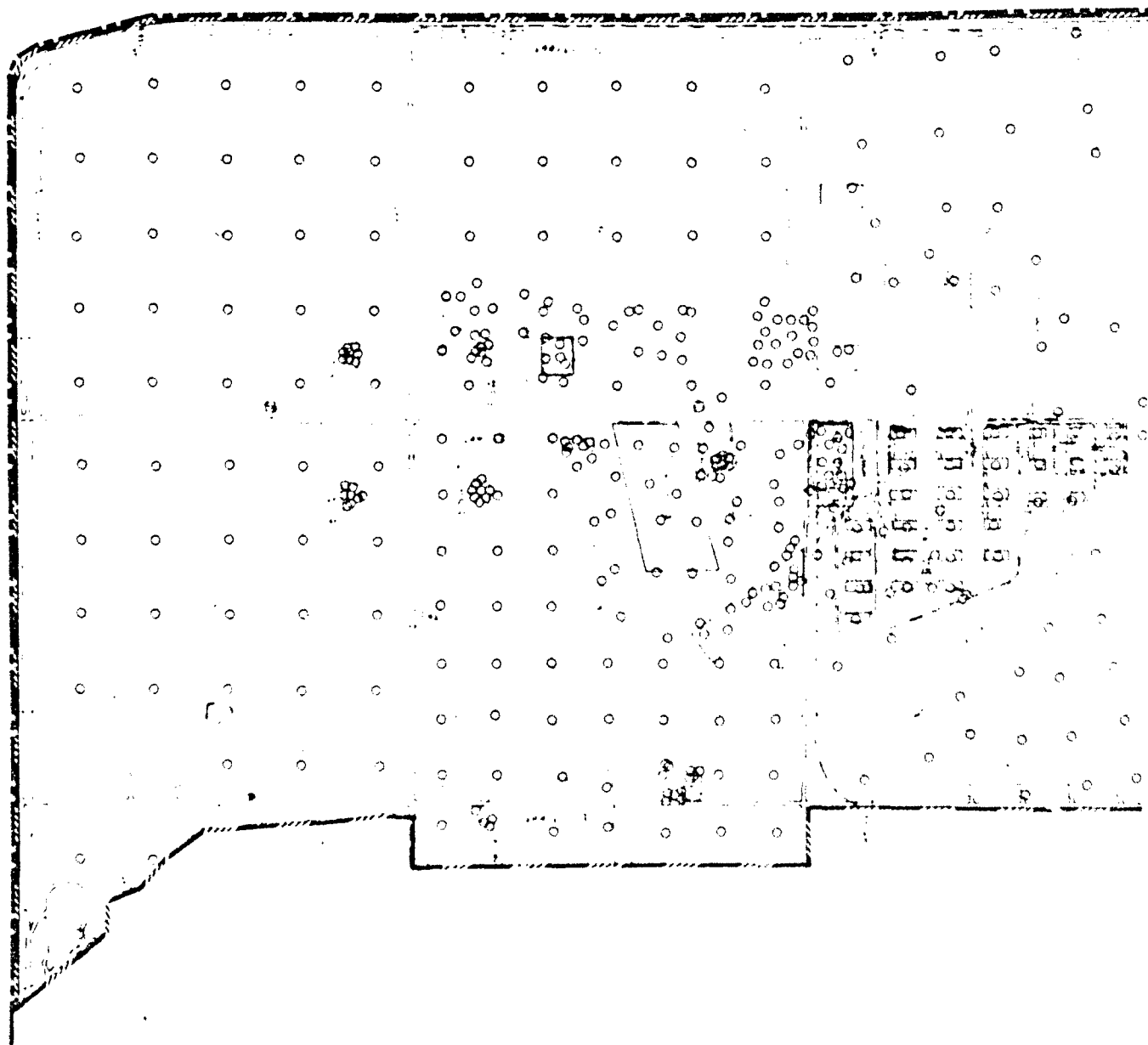
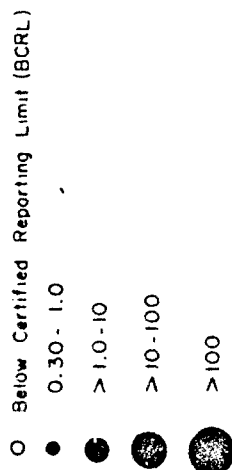
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

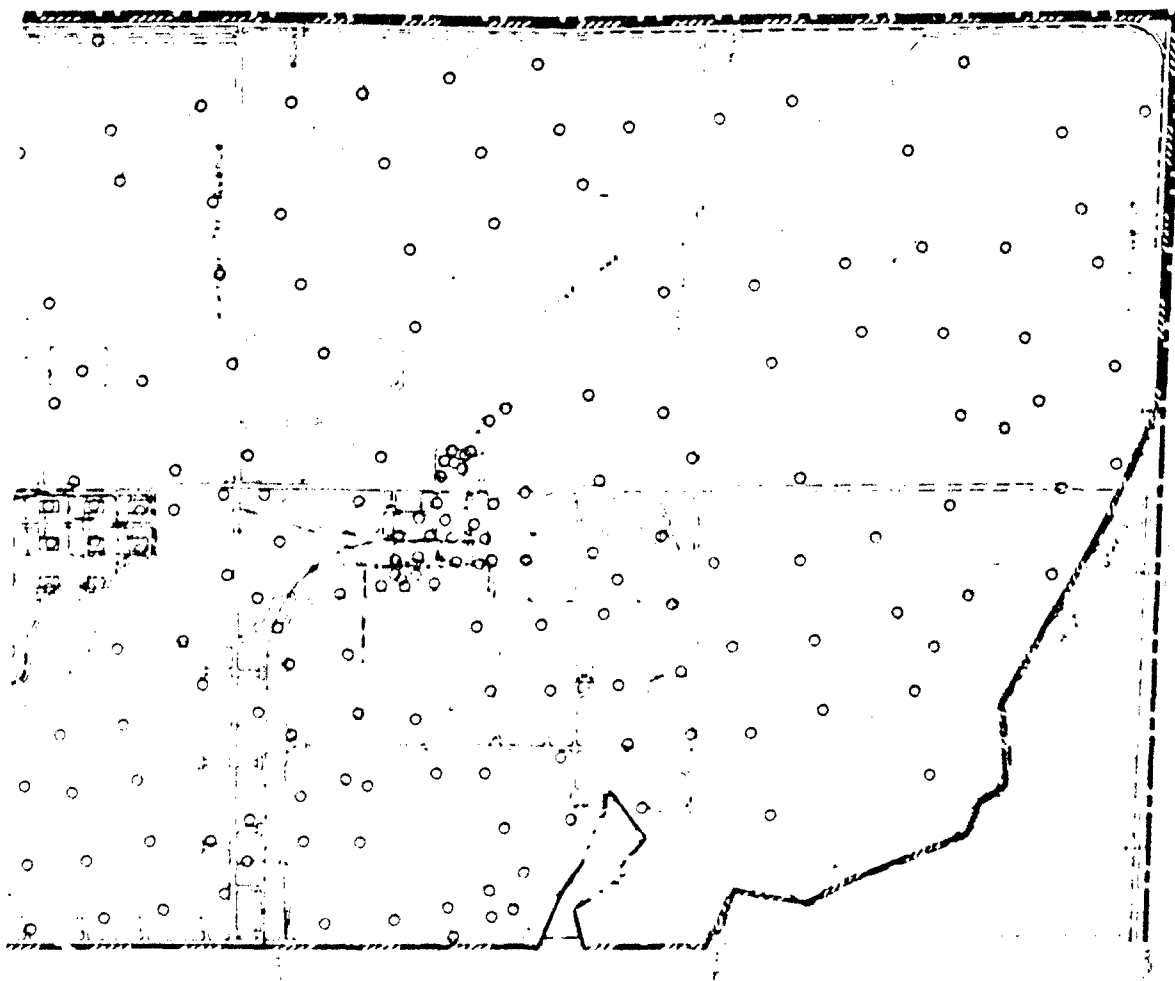
FIGURE ESA 2J-28
Polynuclear Aromatic Hydrocarbons in
Soils in the 0-2 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

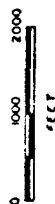
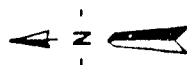
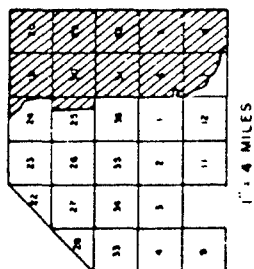


ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/g)





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL

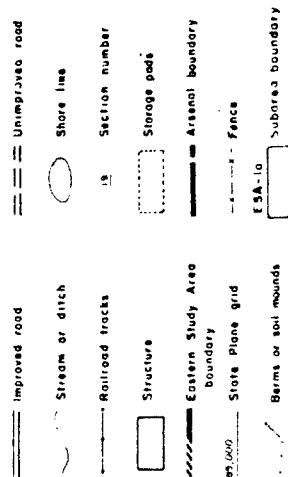


Prepared for:
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Rocky Mountain Arsenal Cleanup

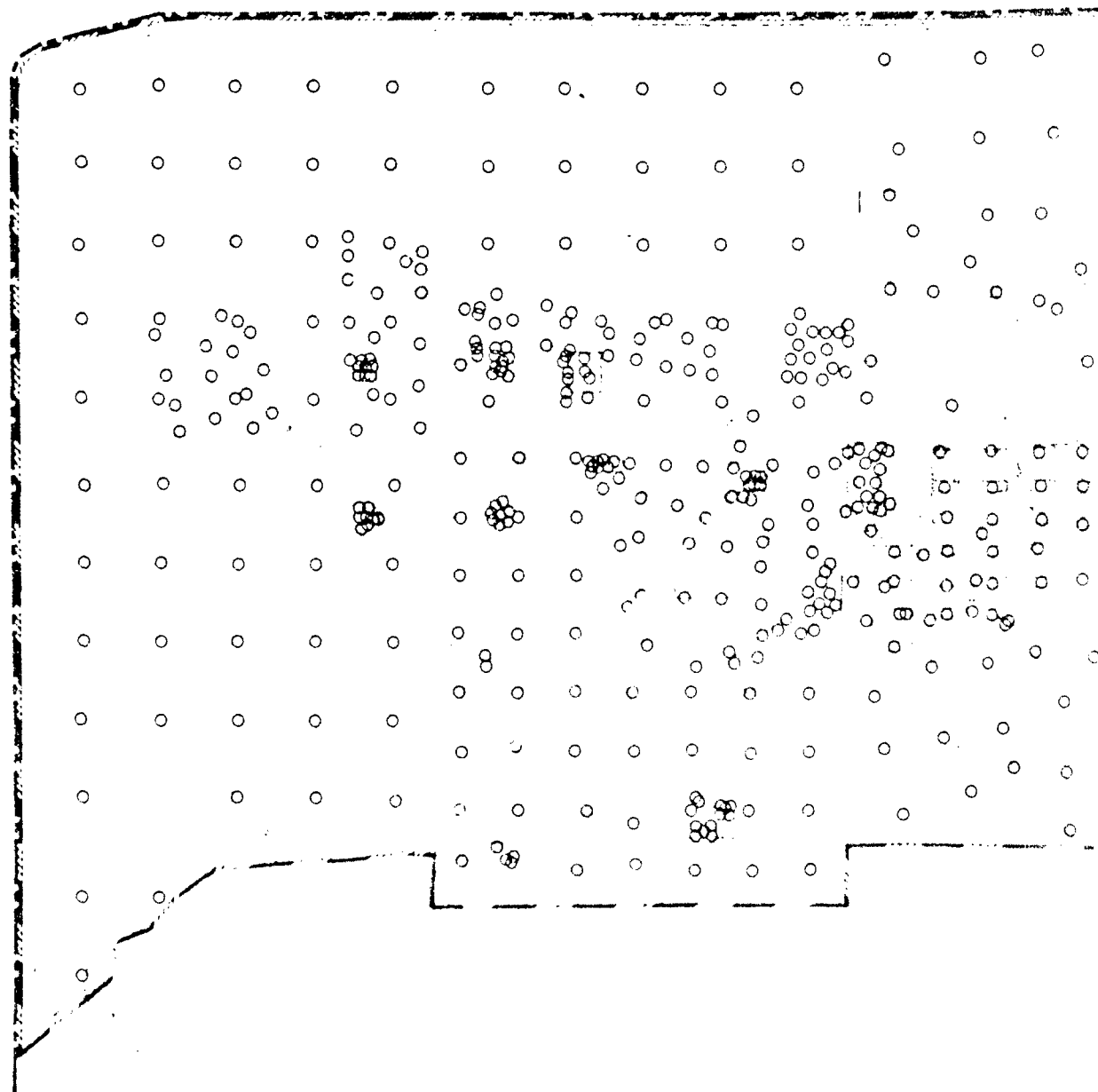
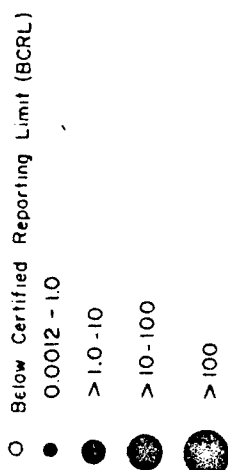
FIGURE ESA 2J-29
Polynuclear Aromatic Hydrocarbons in
Soils in the 2-5 ft. Depth Interval

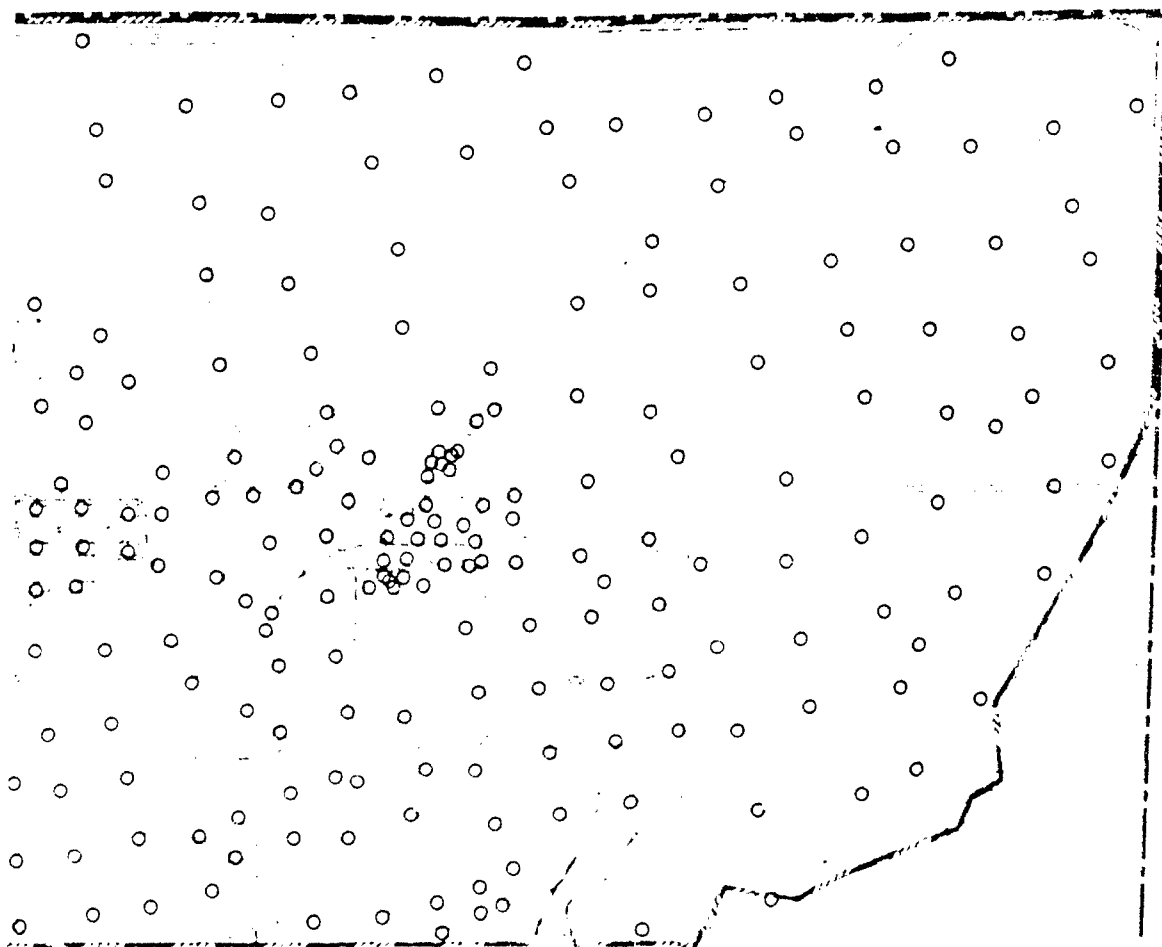
Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

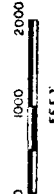
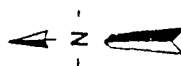
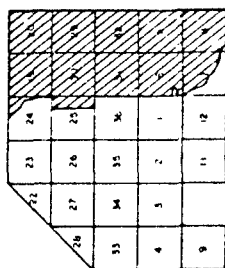


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.1-30

Organochlorine Pesticides in Soils in the
0-2 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

- | | |
|-----------------------------|------------------|
| Improved road | Unimproved road |
| Stream or ditch | Shore line |
| Railroad tracks | Section number |
| Structure | Storage pods |
| Eastern Study Area boundary | Arsenal boundary |
| 100,000 | Fence |
| State Plane grid | ESA-10 |
| Barms or soil mounds | Subarea boundary |

ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/g)

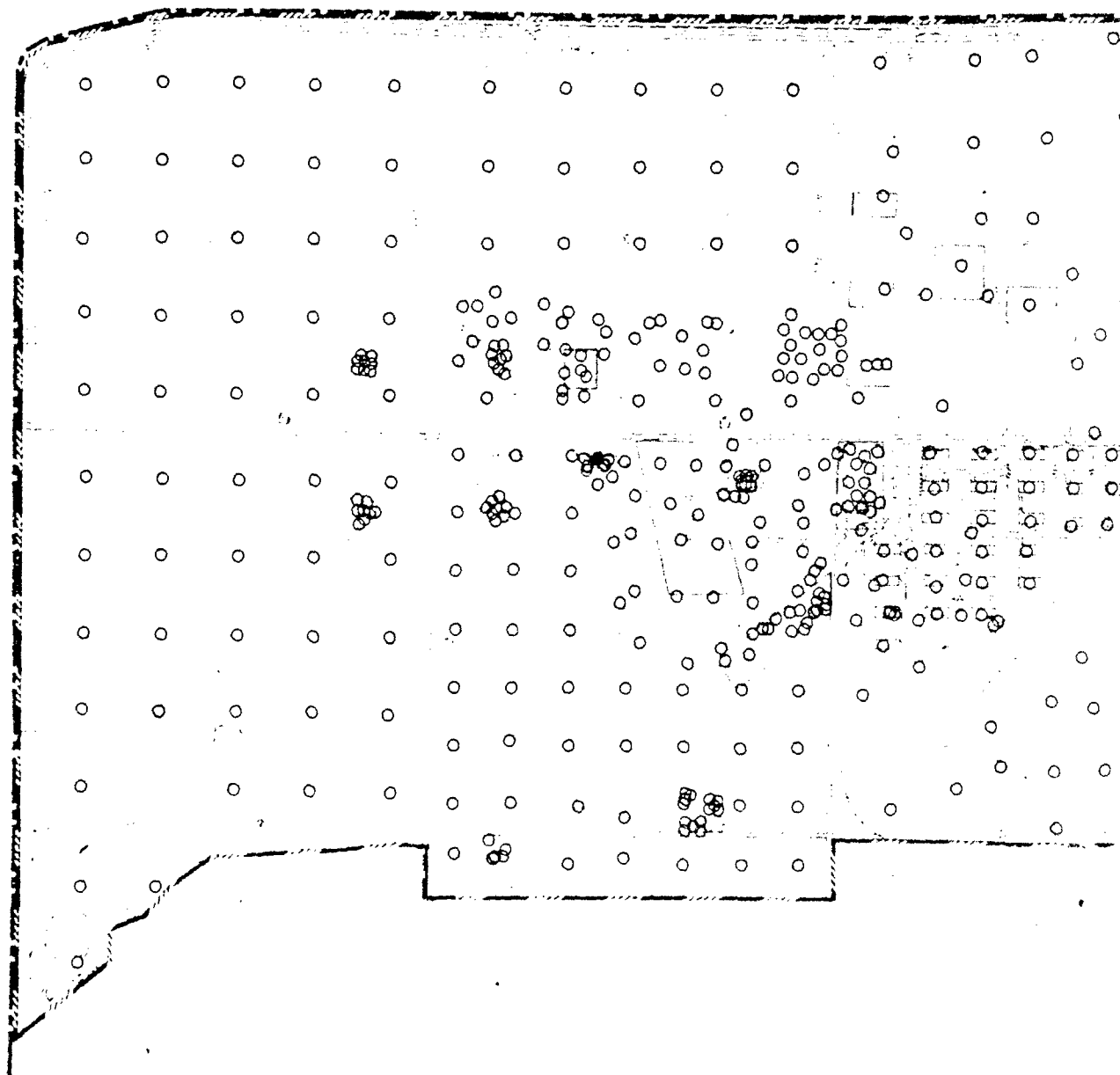
Below Certified Reporting Limit (BCRL)

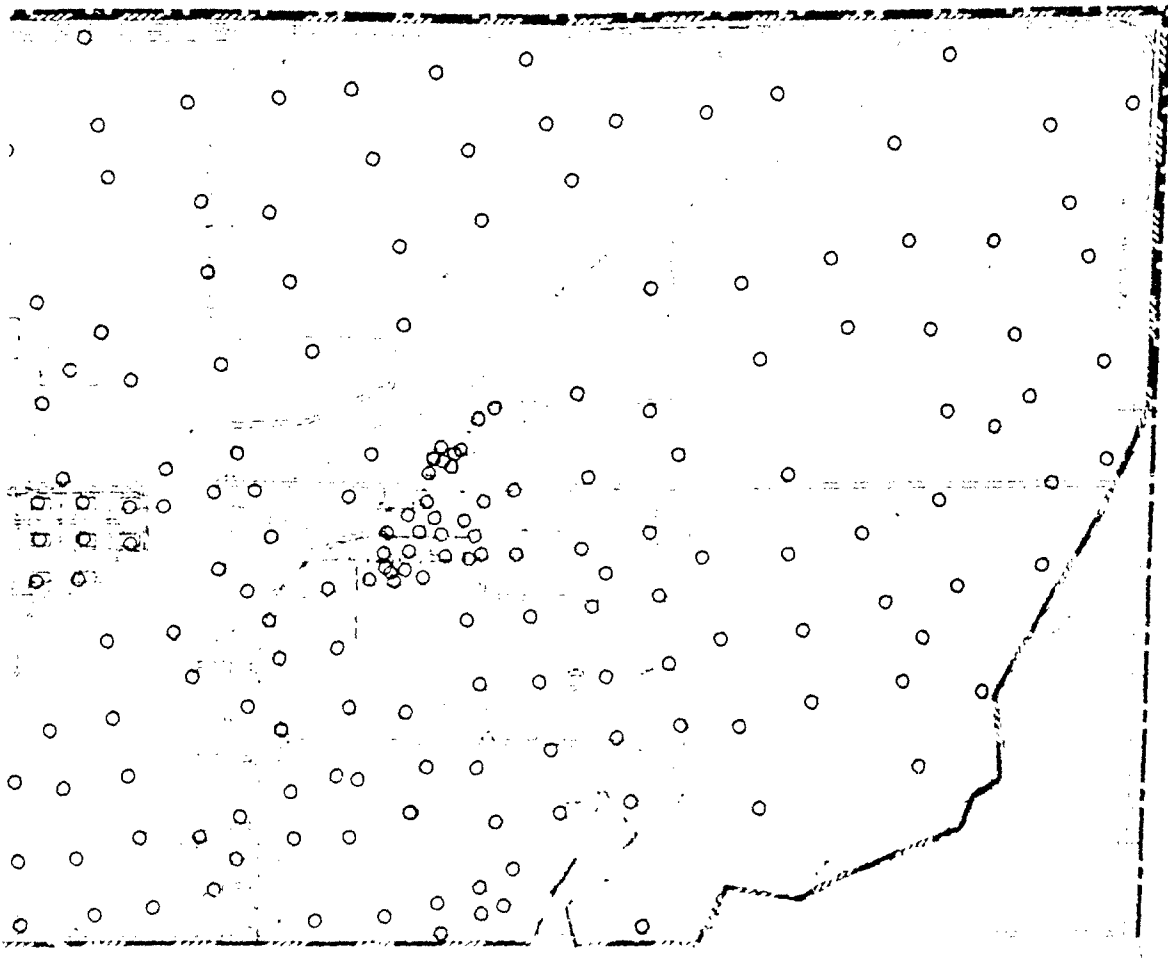
0.0012-1.0

> 1.0-10

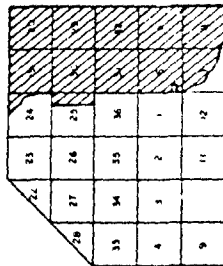
> 10-100

> 100

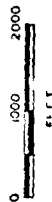
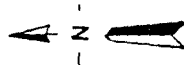




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1/4 MILES



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.1-31

Organochlorine Pesticides in Soils in the
2-5 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

Improved road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Section number
Structure	Storage pad
Eastern Study Area boundary	Arsenal boundary
State Plane grid	Fence
Berms or soil mounds	FSA-10
	Subarea boundary

ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

Below Certified Reporting Limit (BCRL)

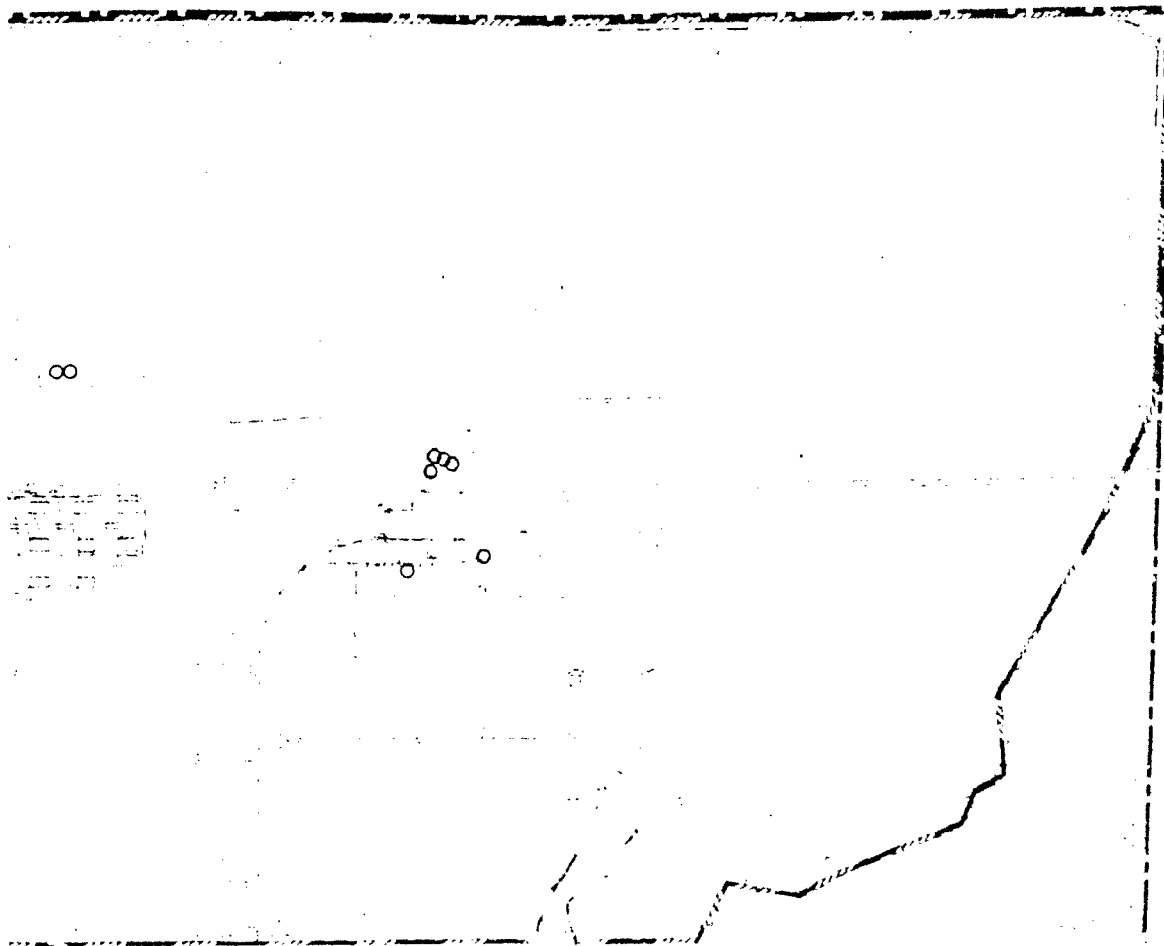
0.0012 - 1.0

> 1.0 - 10

> 10 - 100

> 100

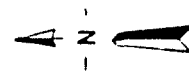




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1/4 MILES



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE -ESA 2.1-32
Organochlorine Pesticides in Soils in the
5-20 ft. Depth Interval
Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

Improved road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Section number
Structure	Storage pad
Eastern Study Area boundary	Arsonal boundary
40,000 State Plane grid	Fence
Burns or soil mounds	FSA-10
	Subarea boundary

ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

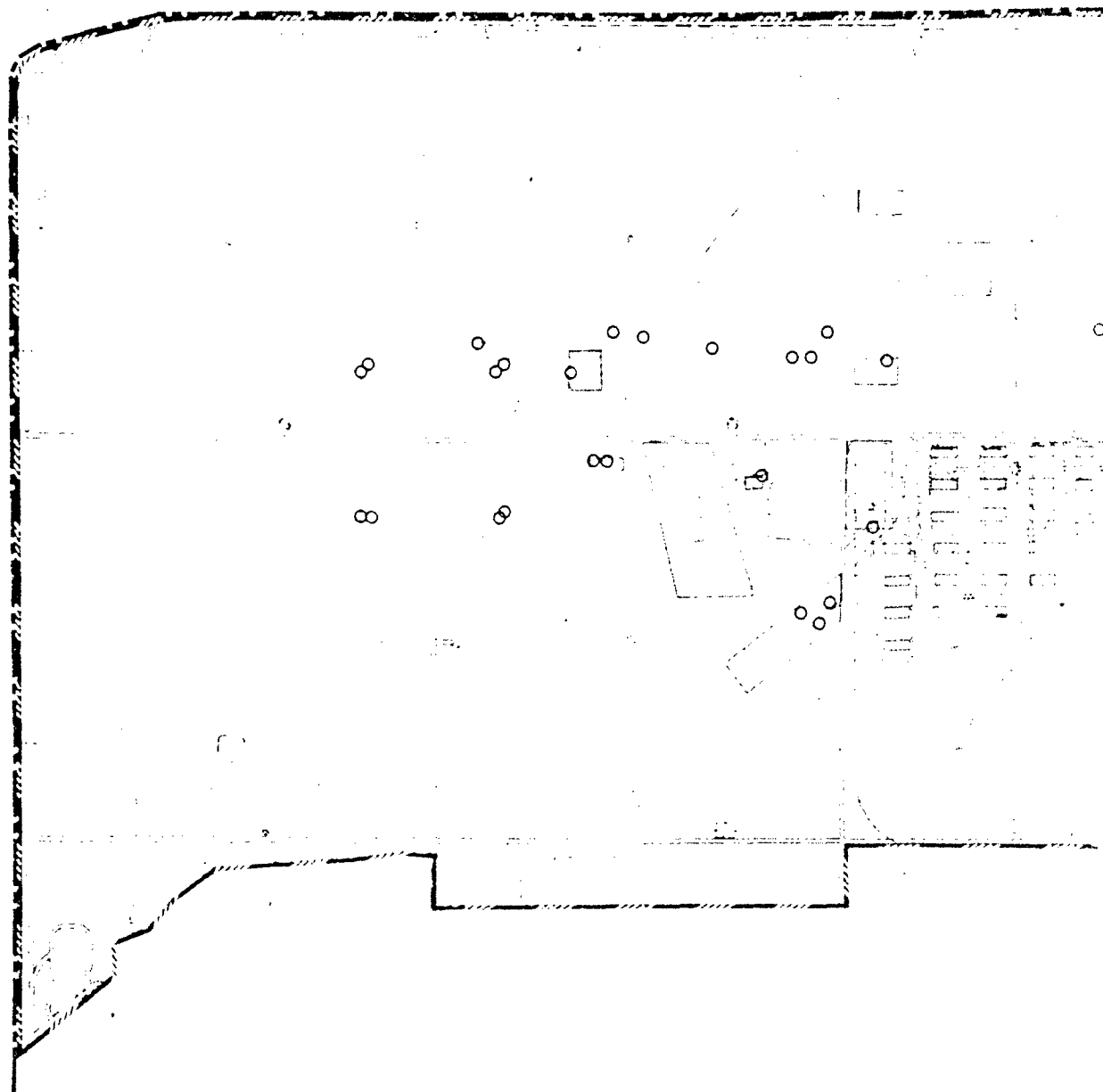
Below Certified Reporting Limit (BCRL)

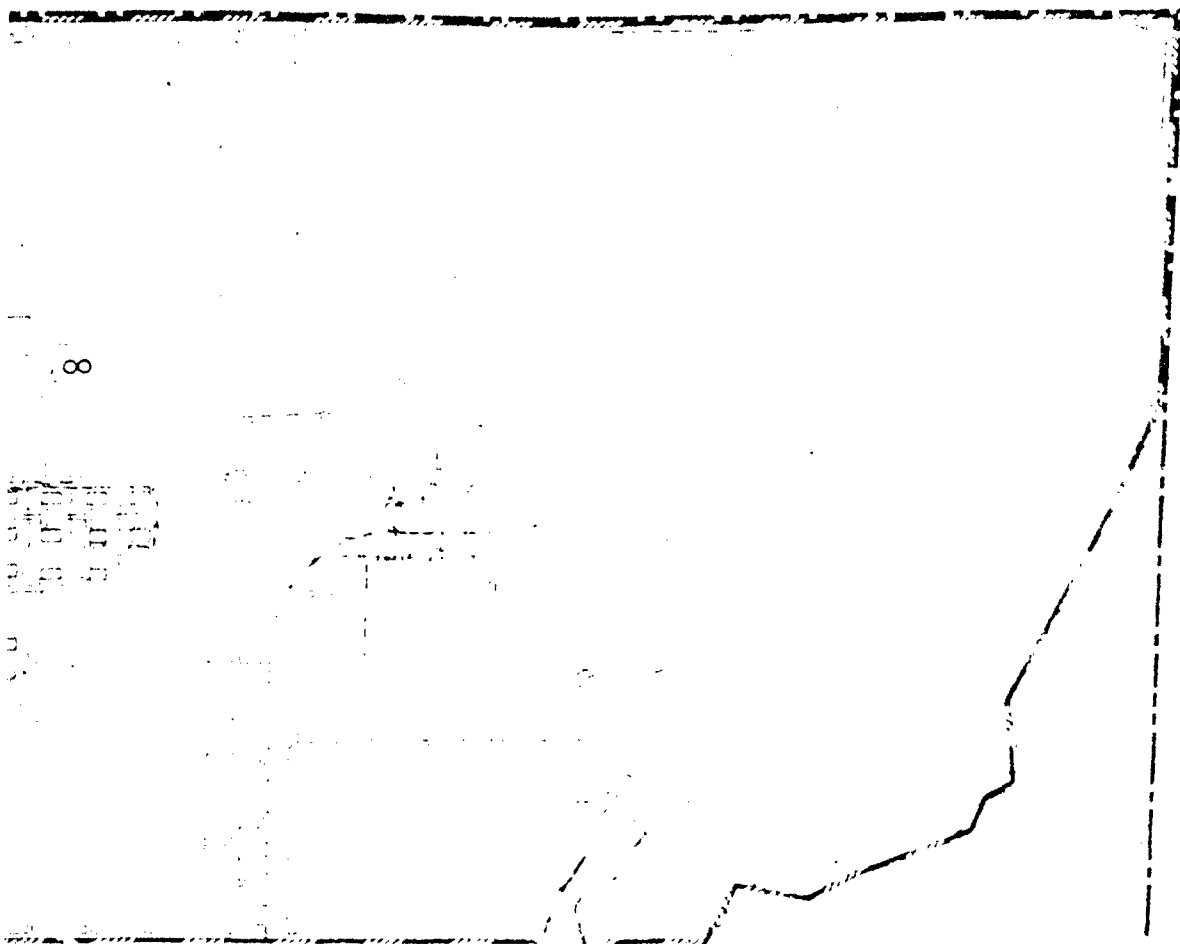
0.0012 - 1.0

> 1.0 - 10

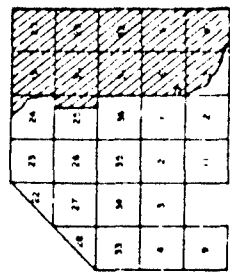
> 10 - 100

> 100

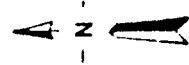




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



0 1000 2000
FEET



Prepared for:

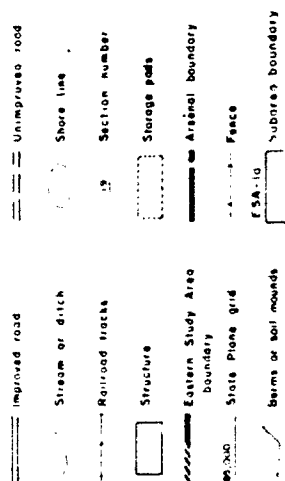
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE -ESA 2.1-33

Organochlorine Pesticides in Soils in the
> 20 ft. Depth Interval

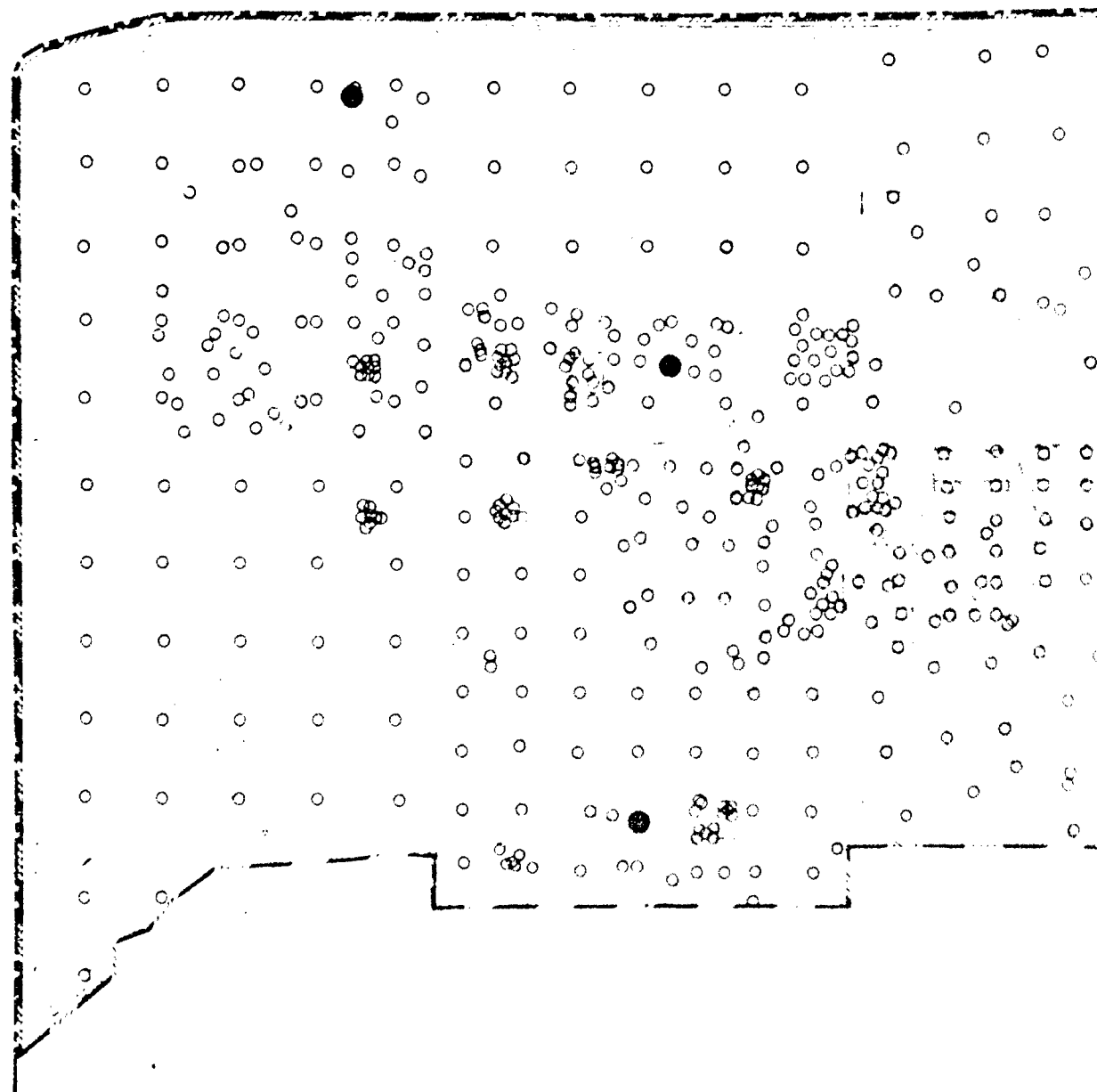
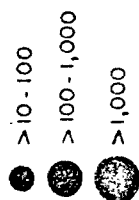
Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

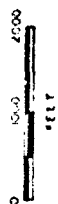
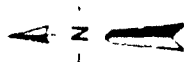
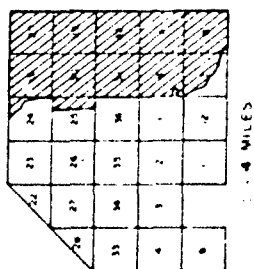


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

Below Certified Reporting Limit (BCRL) to 10 (Indicator Level)



EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



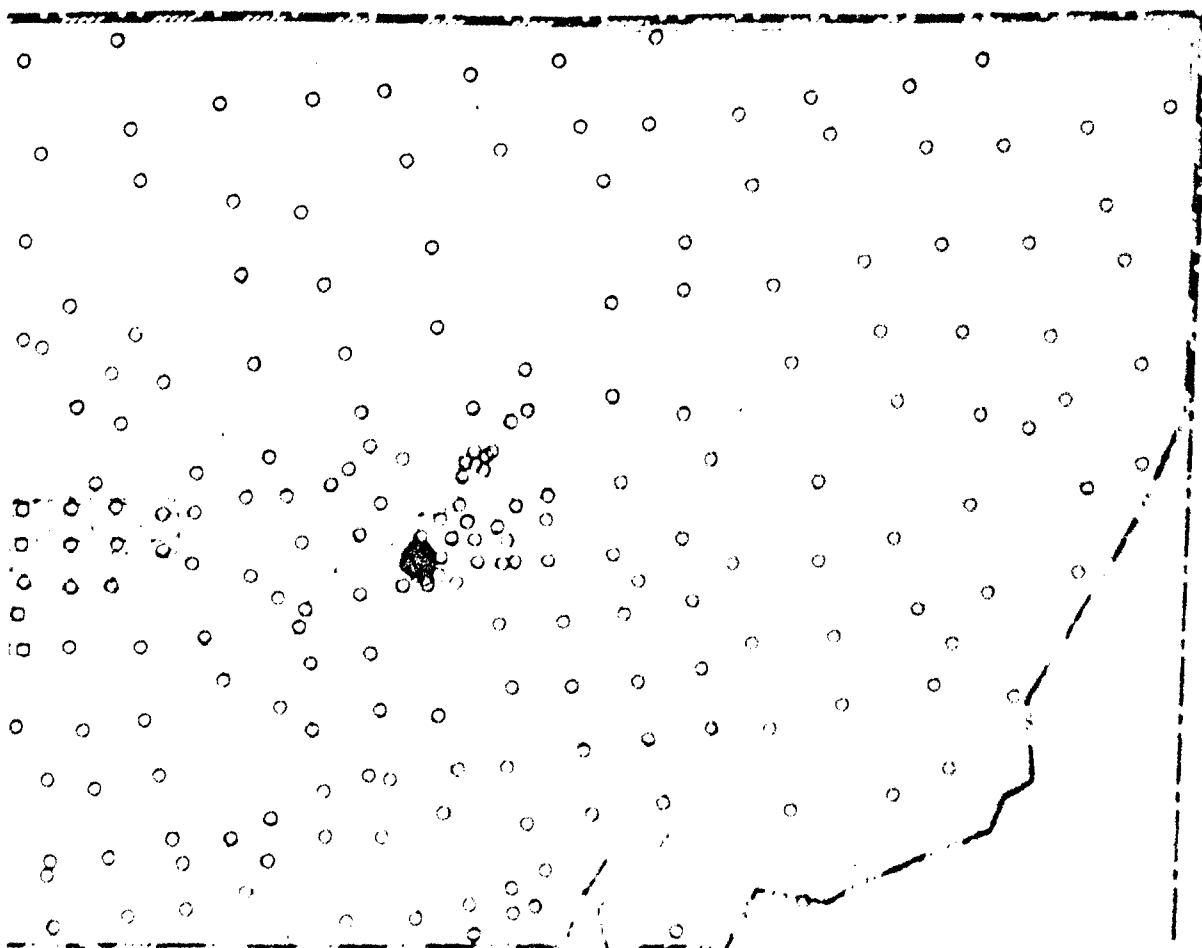
Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

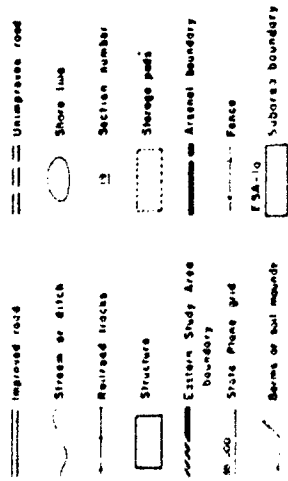
FIGURE ESA 2.1-34

Arsenic in Soils in the 0-2 ft.
Depth Interval

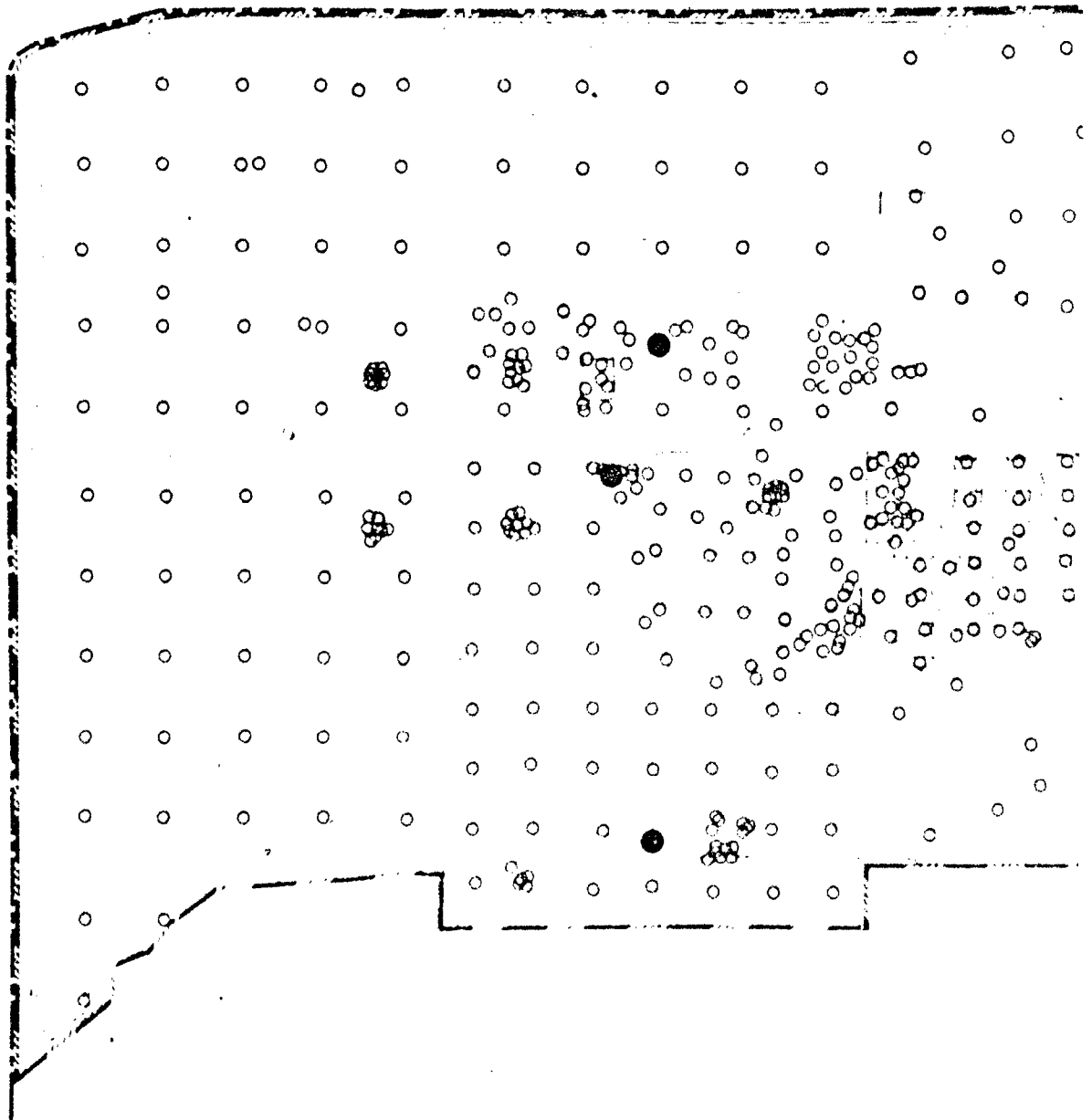
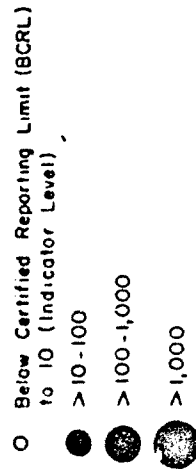
Rocky Mountain Arsenal
Prepared by Ebasco Services Incorporated

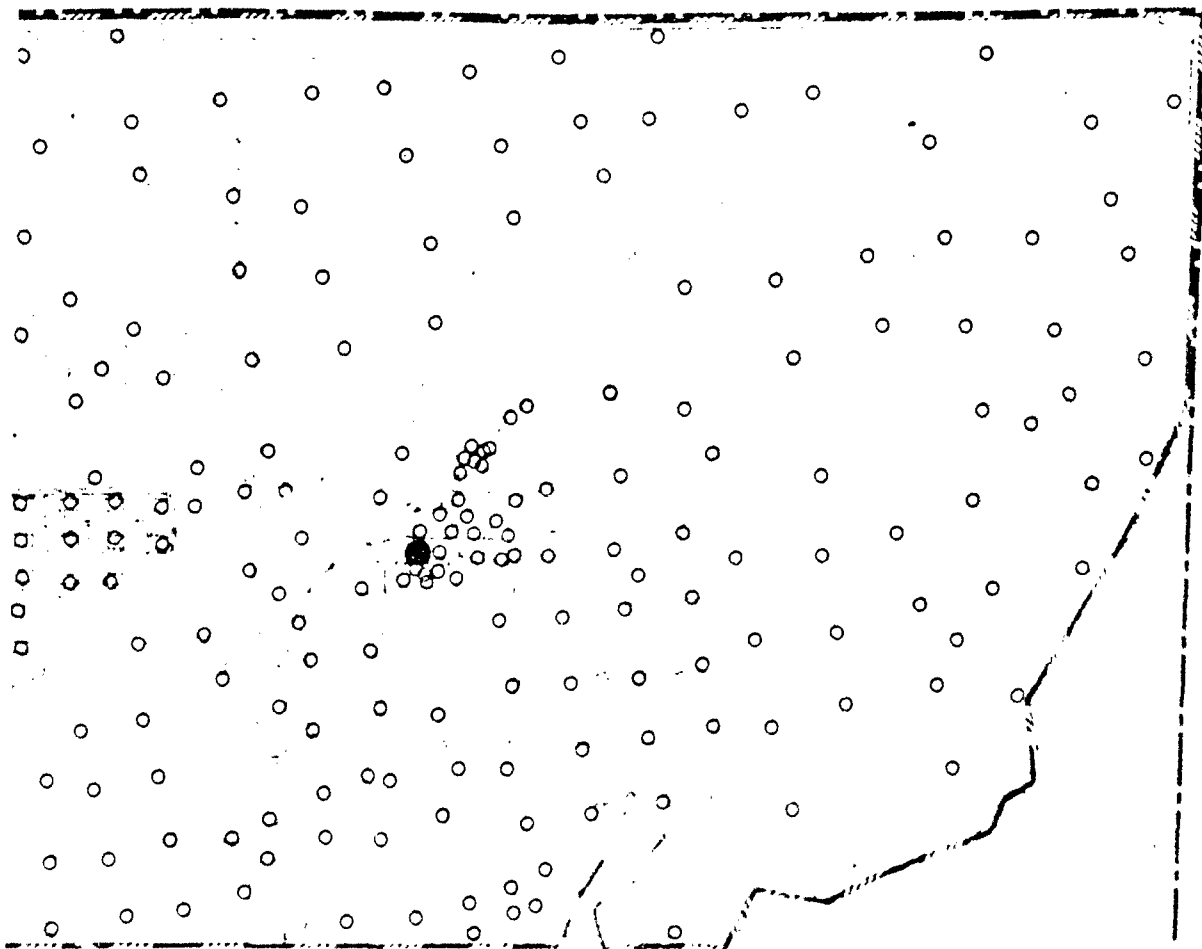


Legend

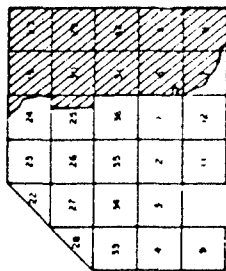


ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/g)

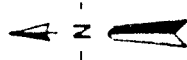




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



0 - 4 MILES



Prepared for:

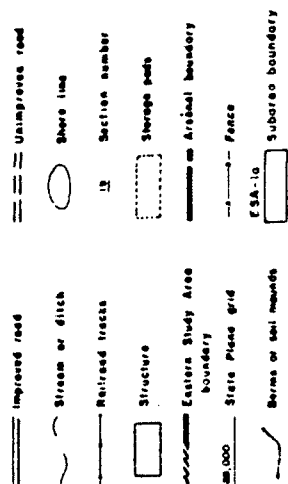
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE -ESA 2.1-35

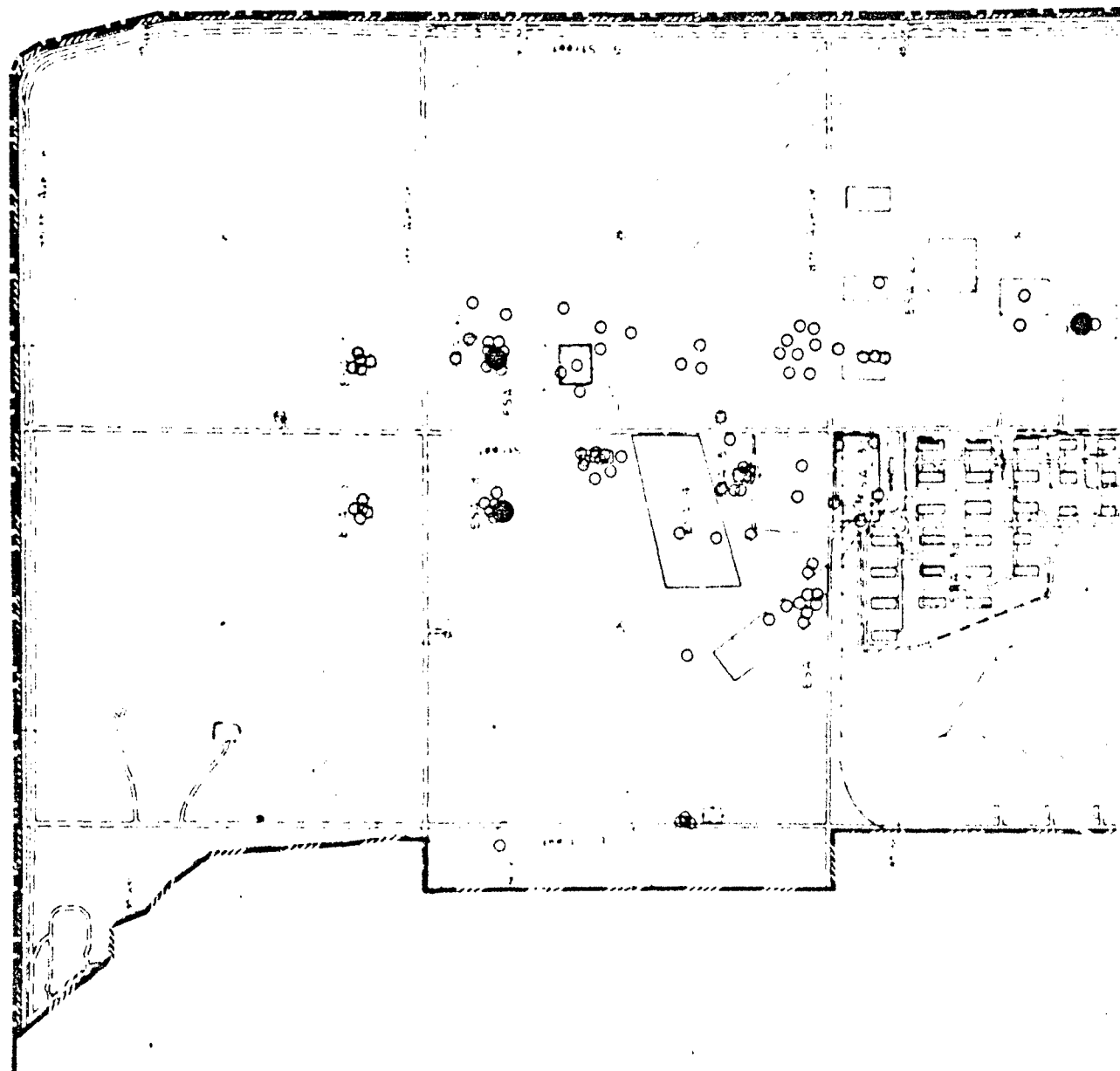
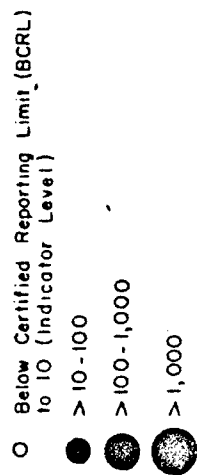
Arsenic in Soils in the 2-5 ft.
Depth Interval

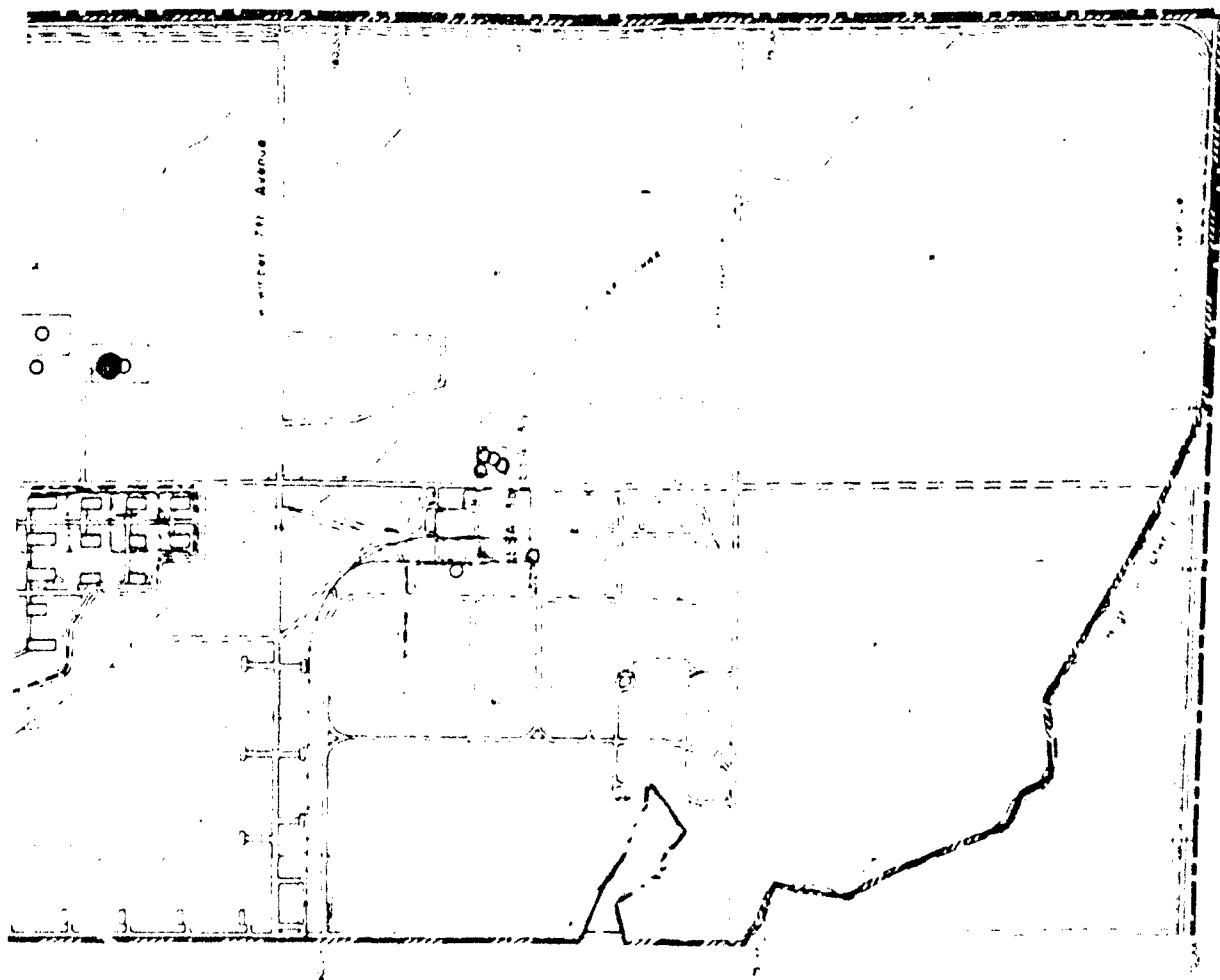
Rocky Mountain Arsenal
Prepared by Ebasco Services Incorporated

UNCLASSIFIED

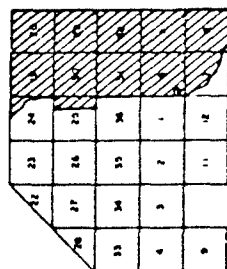


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

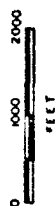
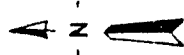




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



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Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.1-36

Arsenic in Soils in the 5-20 ft.
Depth Interval

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated



===== Unimproved road

0
Shore Line

19 Section number

STANDARD

Original Boundary

.....

A-10 **Subarea Boundary**

pool partners

Stream or ditch

— Railroad tracks

Structure

Western Eastern Study Area

100,000 State Police and Sheriff

11-11-11

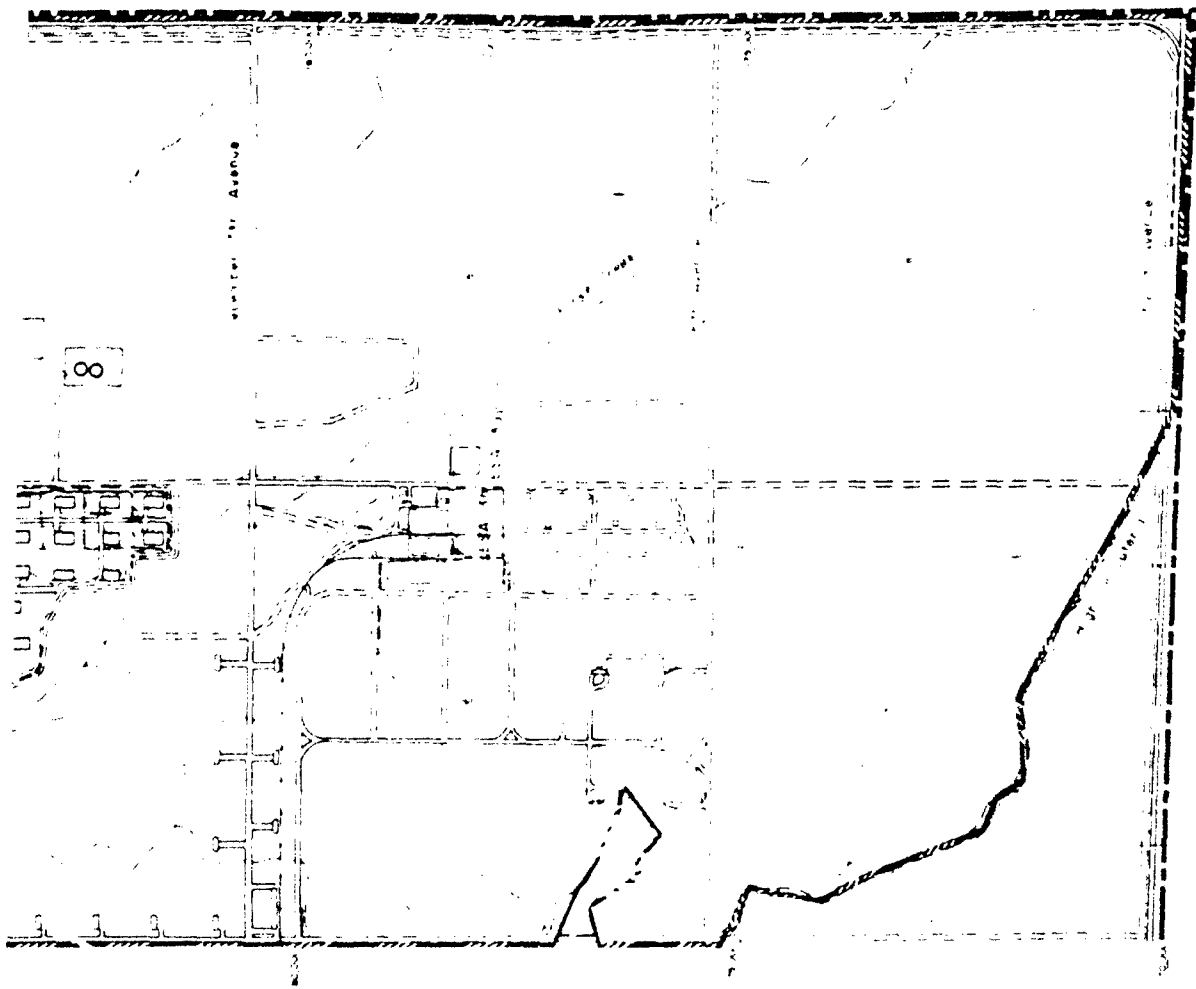
ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/g)

☐ Below Certified Reporting Limit (BCRL)
to 10 (Indicator Level)

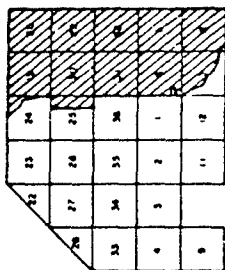
001-100
A

100 - 1,000

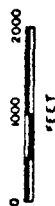
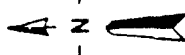
887



EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



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Rocky Mountain Arsenal Cleanup

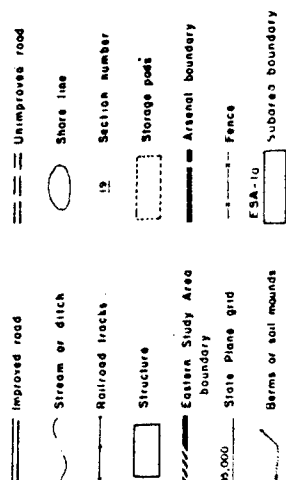
FIGURE ESA 2.1-37

Arsenic in Soils in the >20 ft.
Depth Interval

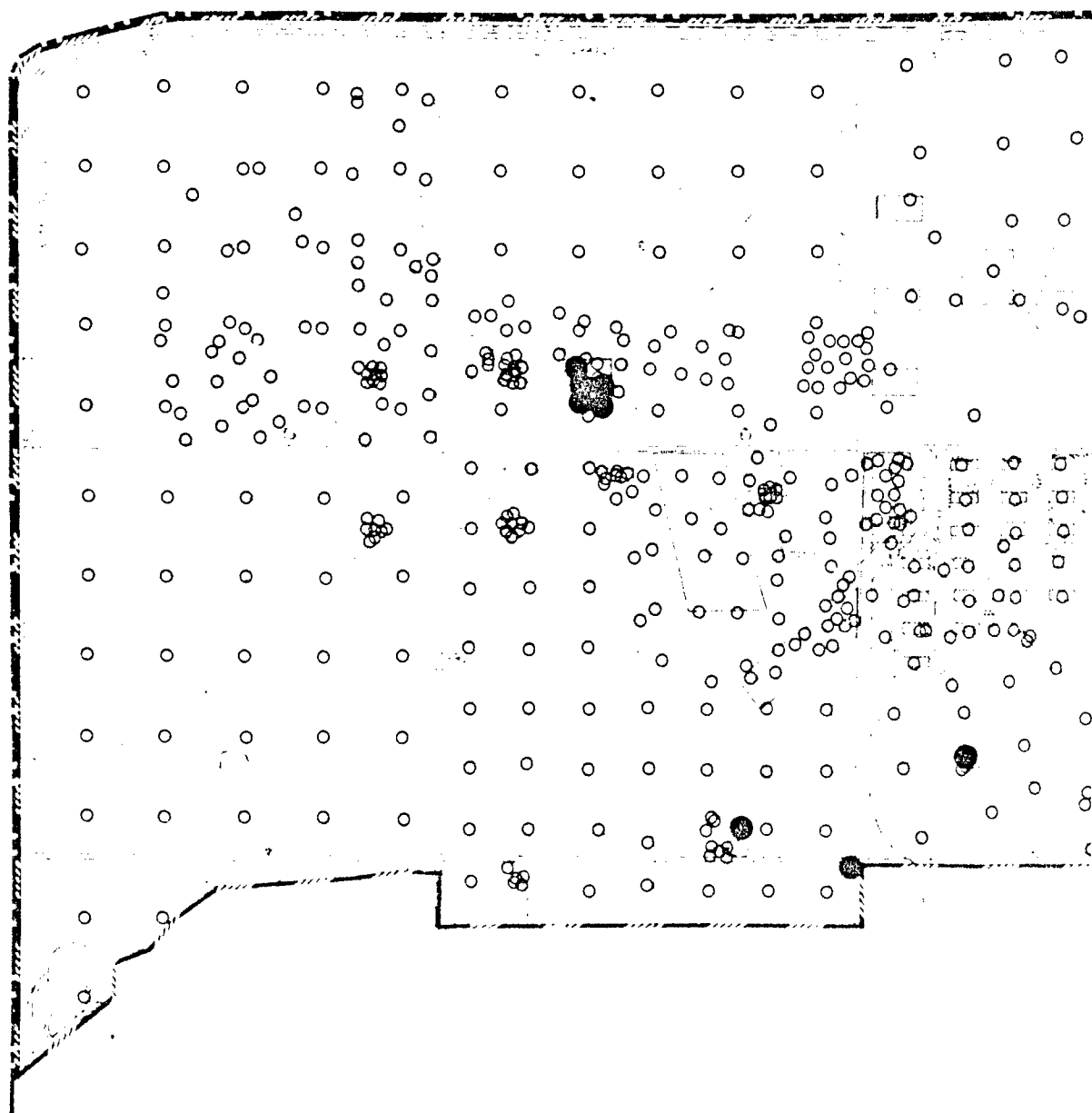
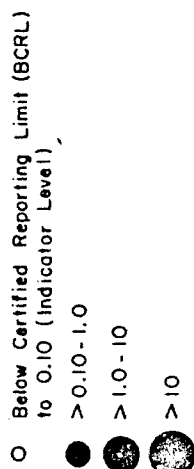
Rocky Mountain Arsenal

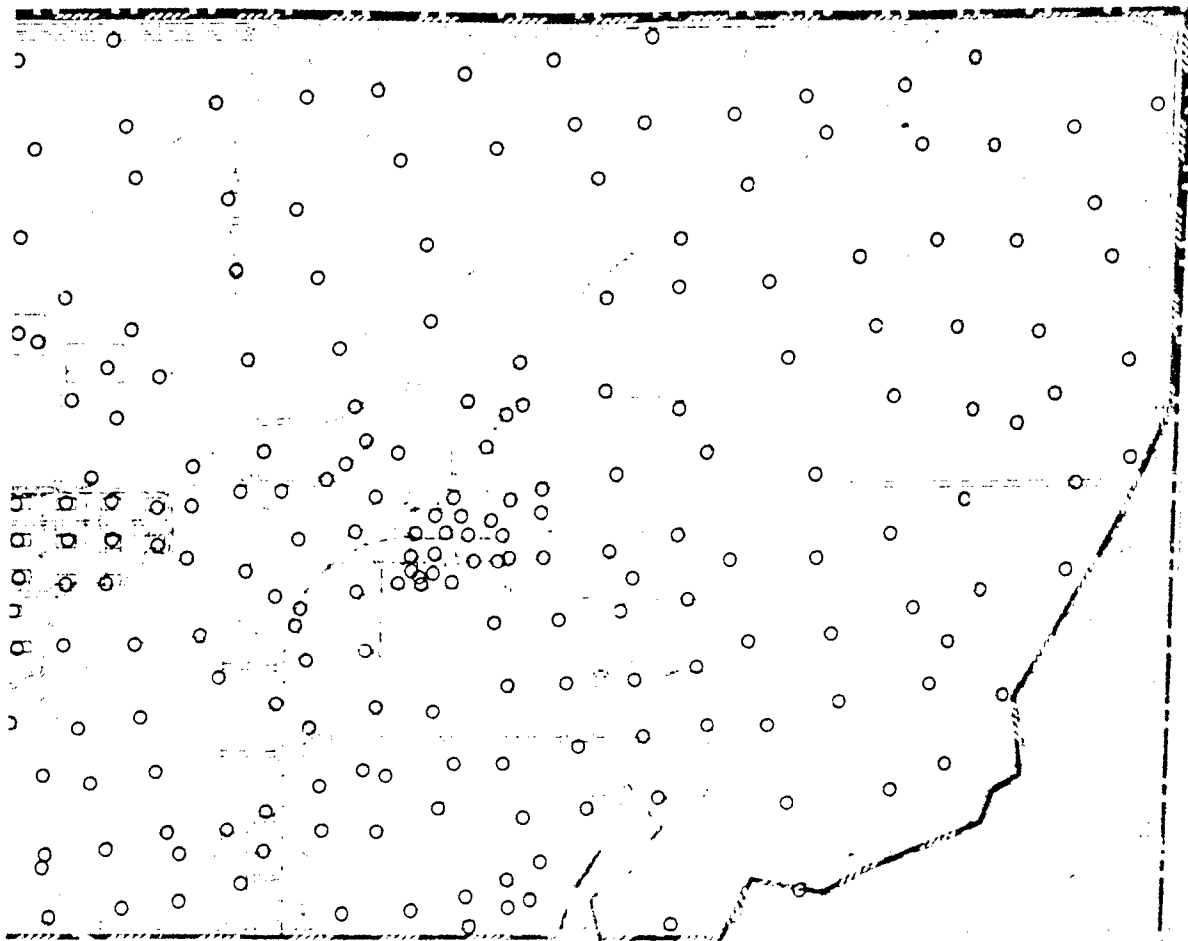
Prepared by: Ebasco Services Incorporated

Legend

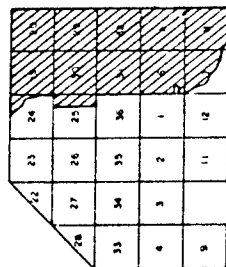


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

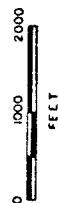
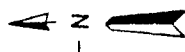




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



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Rocky Mountain Arsenal Cleanup

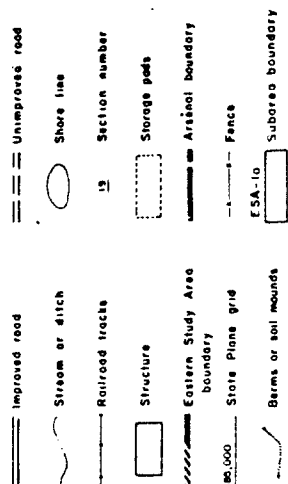
FIGURE ESA 2.1-38

Mercury in Soils in the 0-2 ft.
Depth Interval

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

Legend



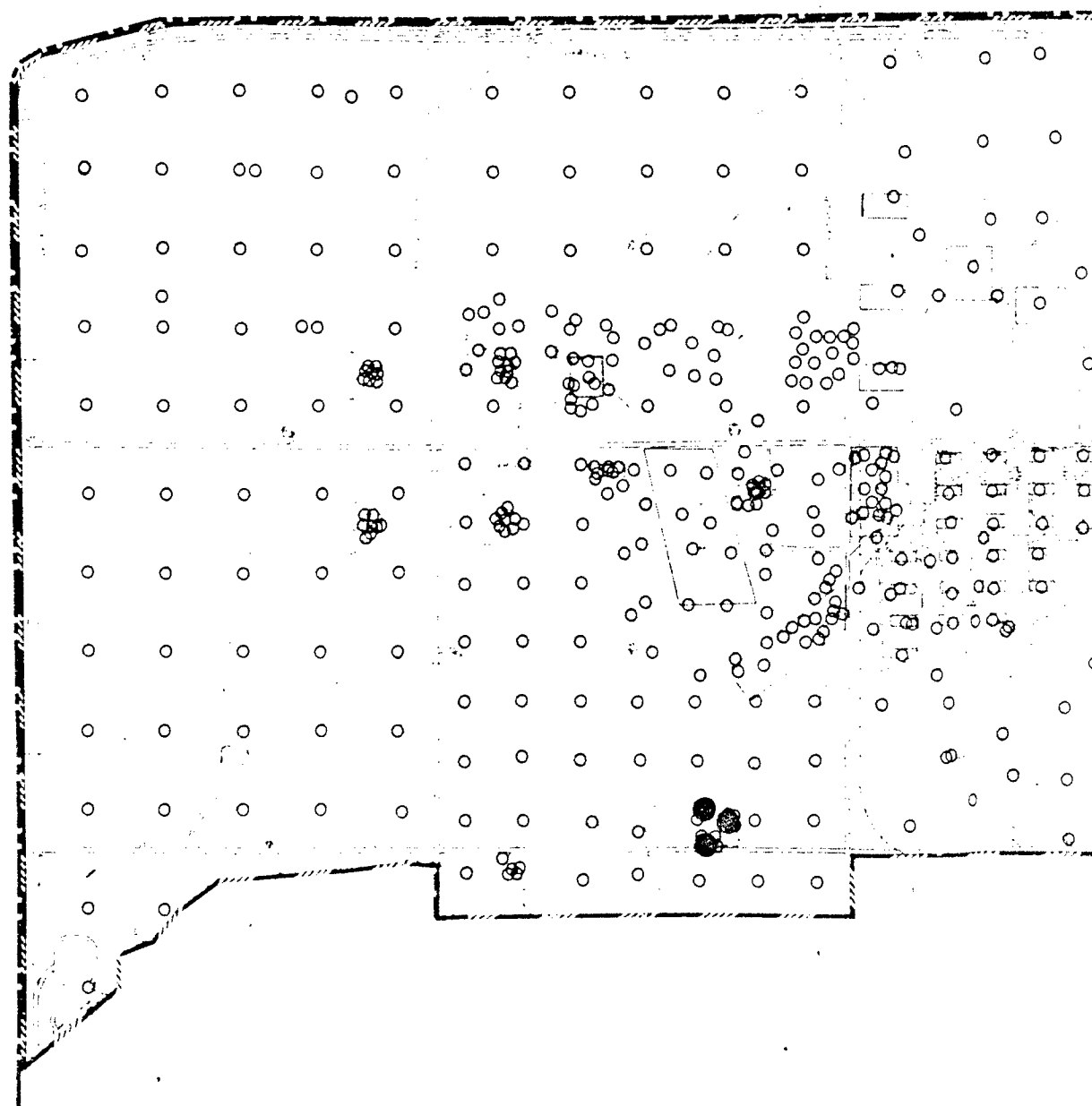
ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

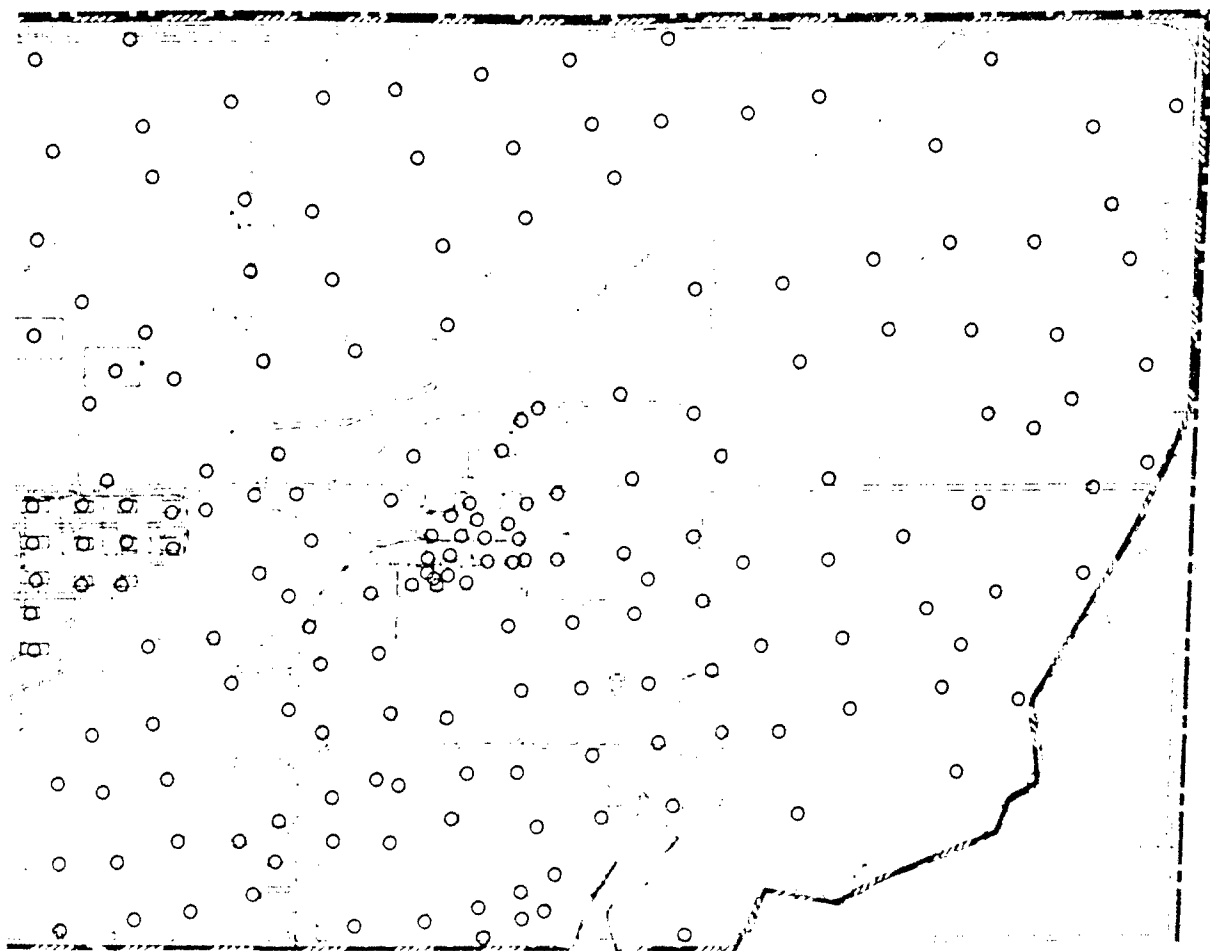
○ Below Certified Reporting Limit (BCRL)
to 0.10 (Indicator Level)

● > 0.10 - 1.0

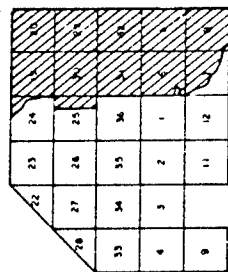
● > 1.0 - 10

● > 10

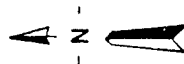




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



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Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.1-39

Mercury in Soils in the 2-5 ft.
Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

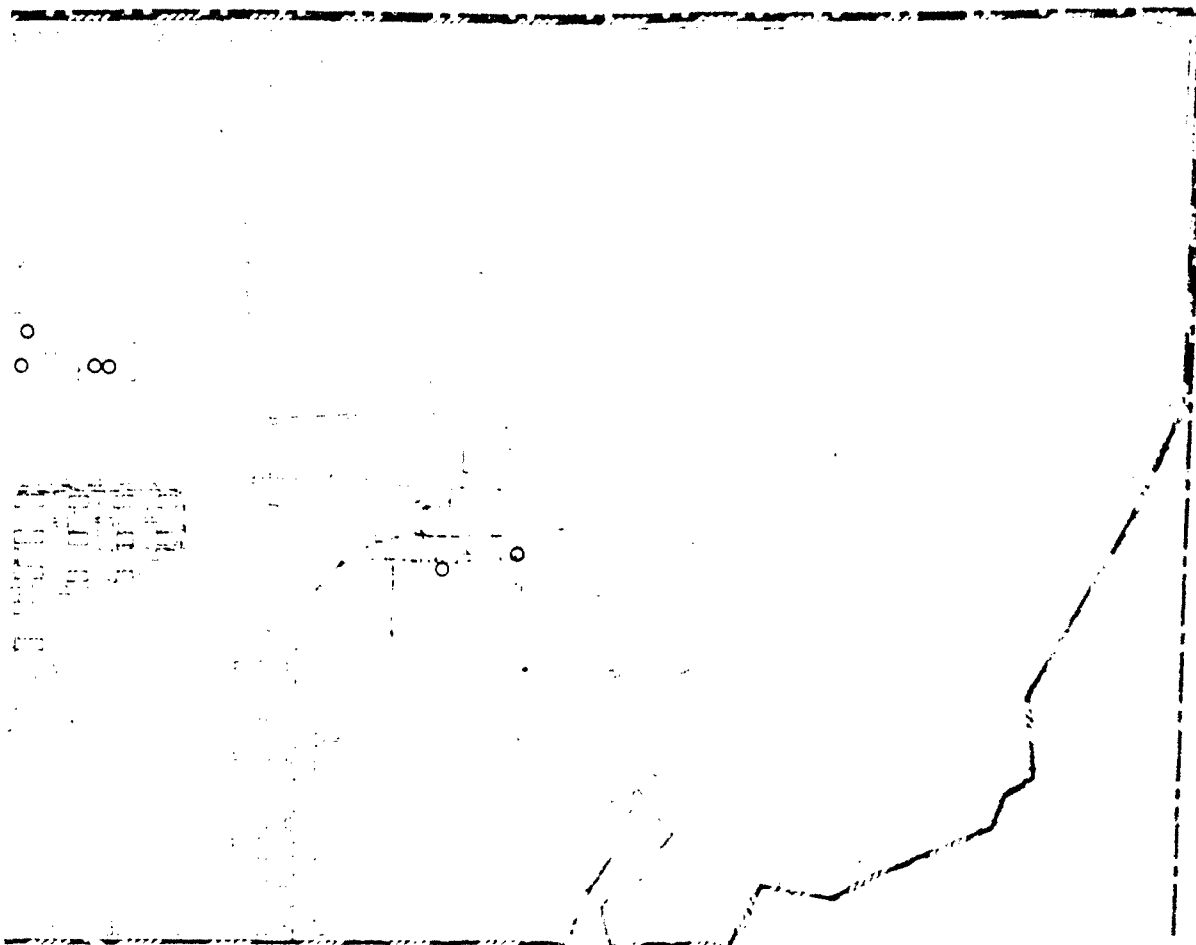
Legend

==	Improved road	==	Unimproved road
~	Stream or ditch	○	Shore line
—	Railroad tracks	12	Section number
□	Structure	□	Storage pads
---	Eastern Study Area boundary	---	Arsenal boundary
10,000	State Plane grid	---	Fence
~	Berms or soil mounds	FSA-10	Subarea boundary

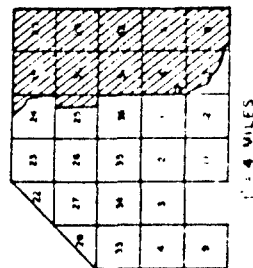
ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

- Below Certified Reporting Limit (BCRL) to 0.10 (Indicator Level)
- > 0.10 - 1.0
- > 1.0 - 10
- > 10

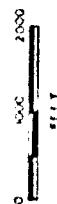
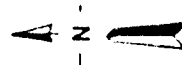




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE -ESA 2.i-40

Mercury in Soils in the 5-20 ft.
Depth Interval

Rocky Mountain Arsenal
Prepared by Ebosco Services Incorporated

Legend

Improved road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Section number
Structure	Storage pods
Eastern Study Area boundary	Armed boundary
State Plane grid	Fence
Burms or soil mounds	FSA-10
	Subarea boundary

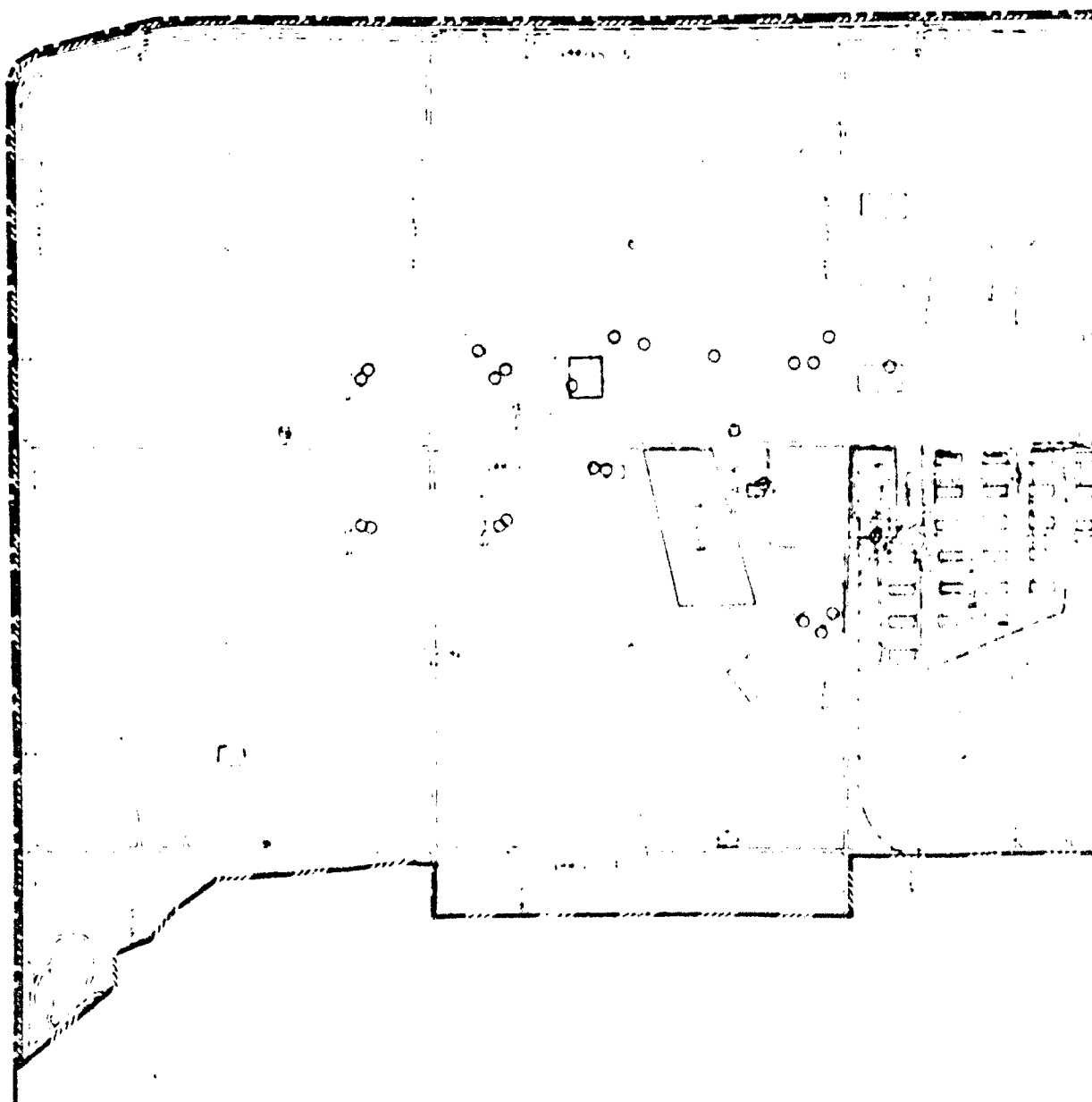
ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

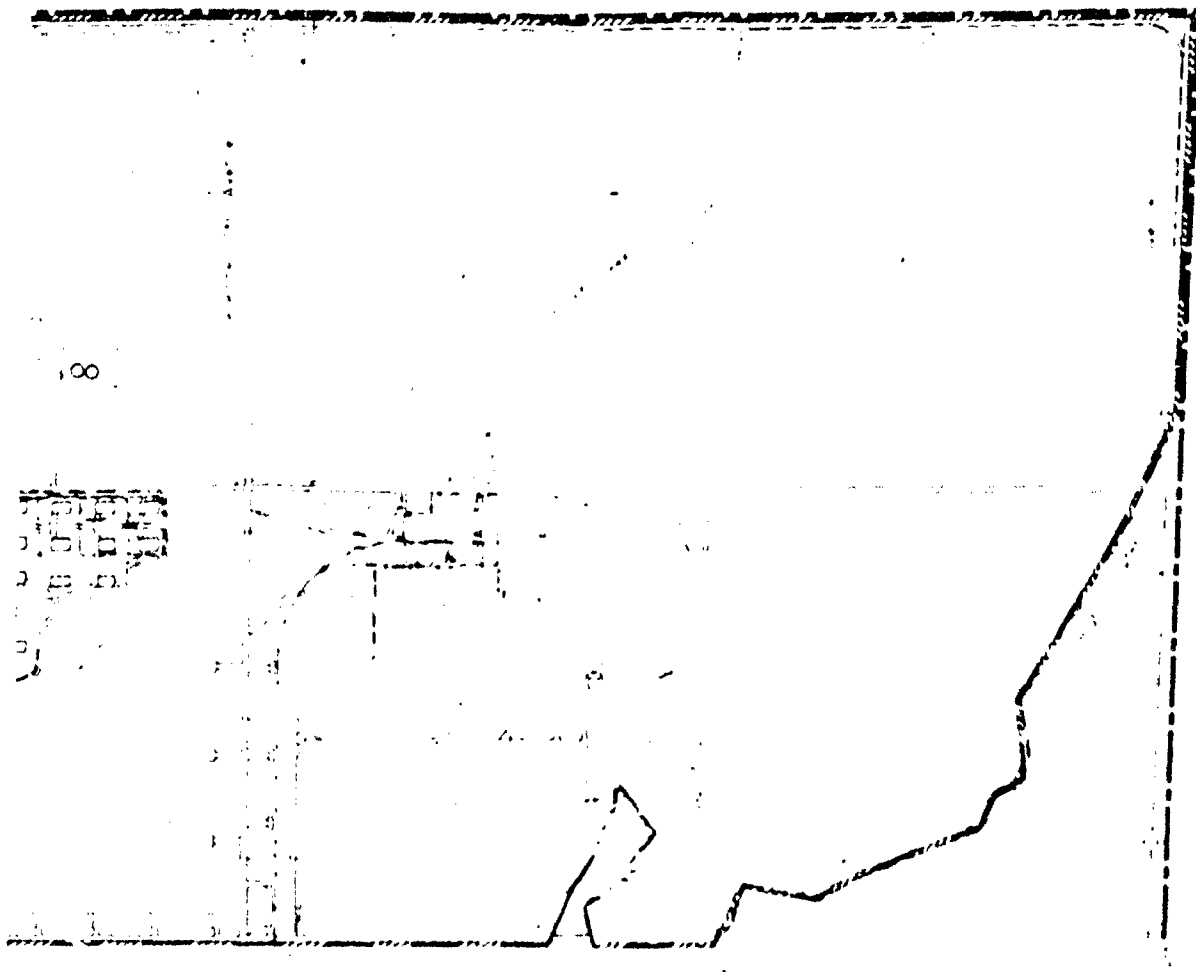
○ Below Certified Reporting Limit (BCRL)
to 0.10 (Indicator Level)

● > 0.10 - 1.0

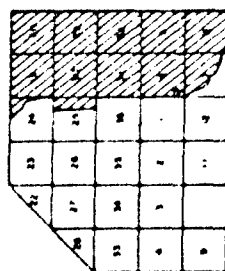
● > 1.0 - 10

● > 10

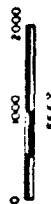
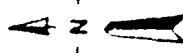




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1.4 MILES

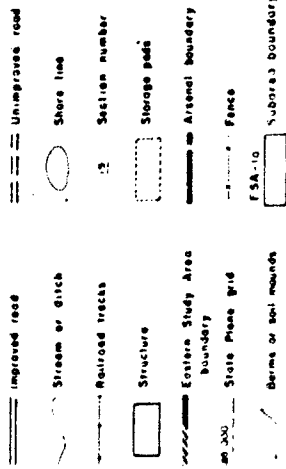


Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

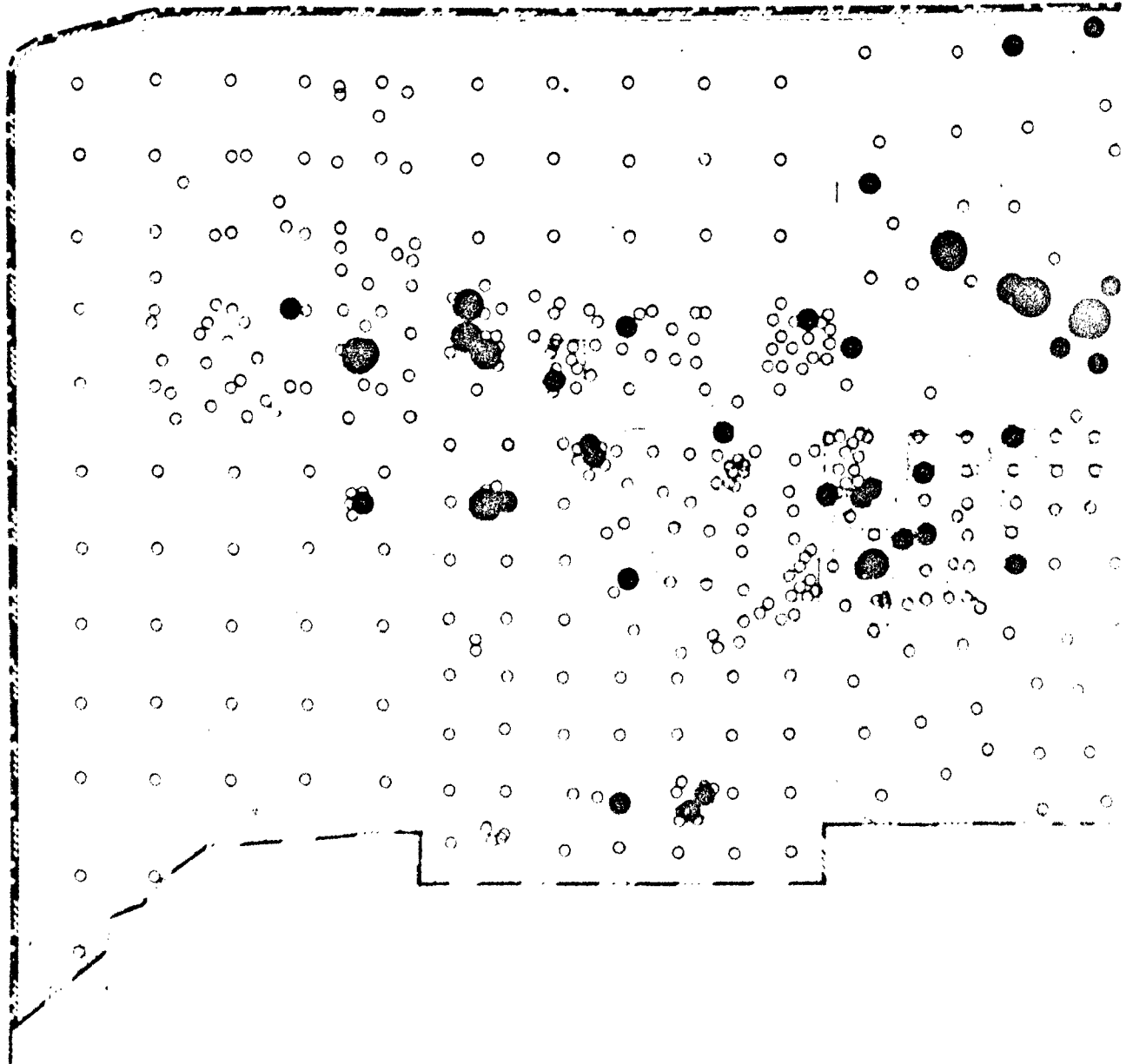
FIGURE ESA 2.1-41
Mercury in Soils in the >20 ft.
Depth Interval

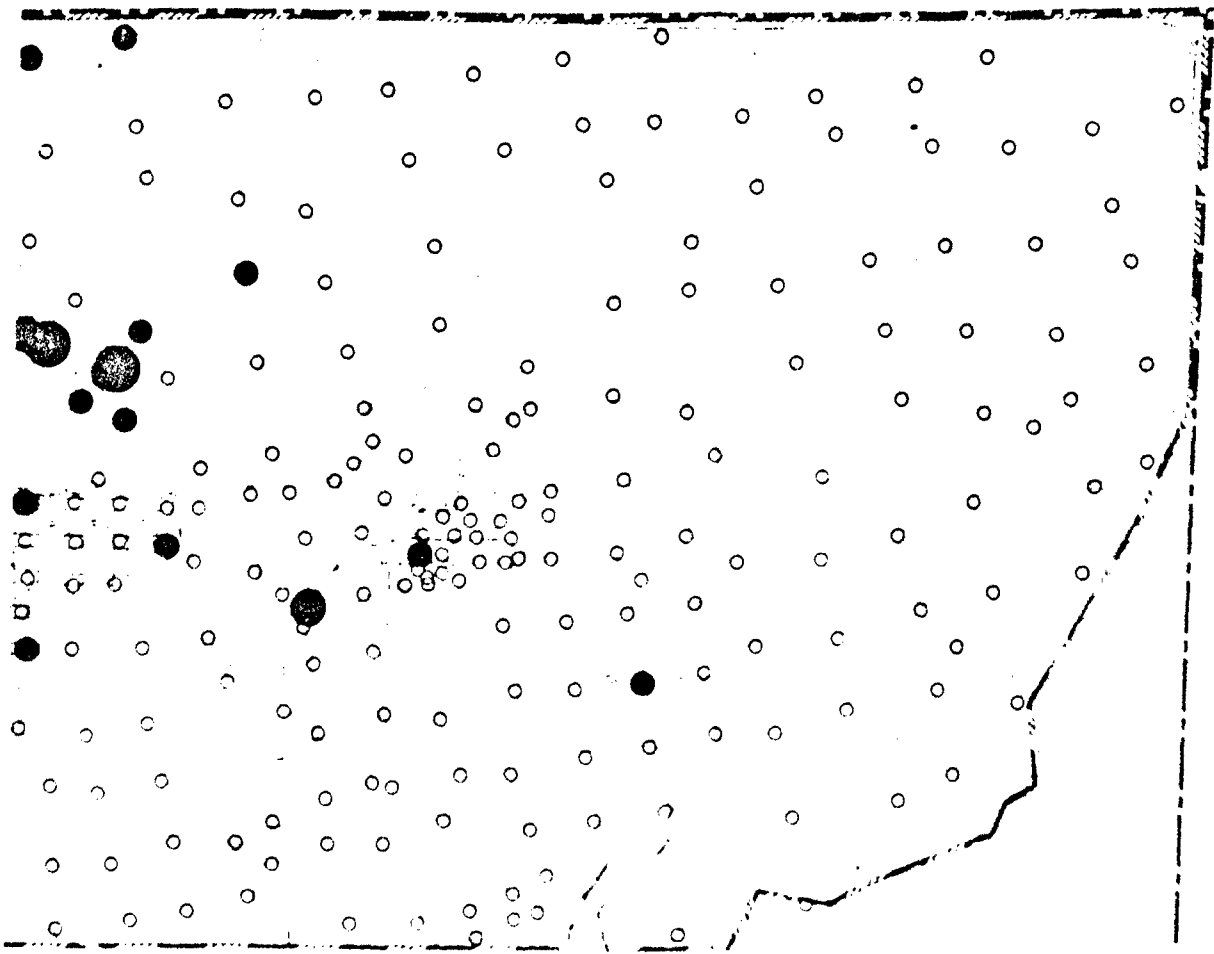
Rocky Mountain Arsenal
Prepared by Ebasco Services Incorporated



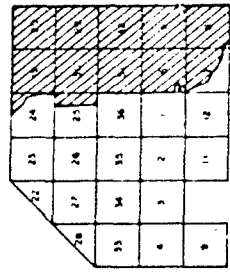
ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

	Cd	Cr	Cu	Pb	Zn
○	BCRL-2.0	BCRL-40	BCRL-35	BCRL-40	BCRL-80
●	>2.0-10	>40-100	>35-100	>40-100	>80-1,000
●	>10-100	>100-1,000	>100-1,000	>100-1,000	>1,000-10,000
●	>100	>1,000	>1,000	>1,000	>10,000

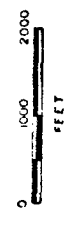
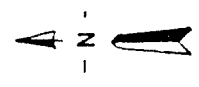




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1/4 MILES



Prepared for:

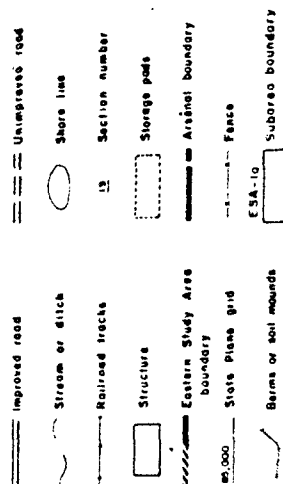
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.1-42

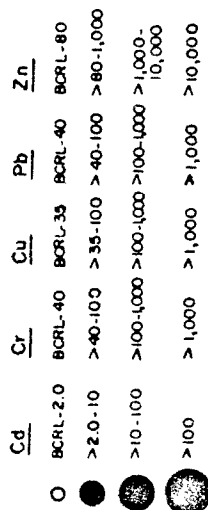
ICP Metals in Soils in the
0-2 ft. Depth Interval

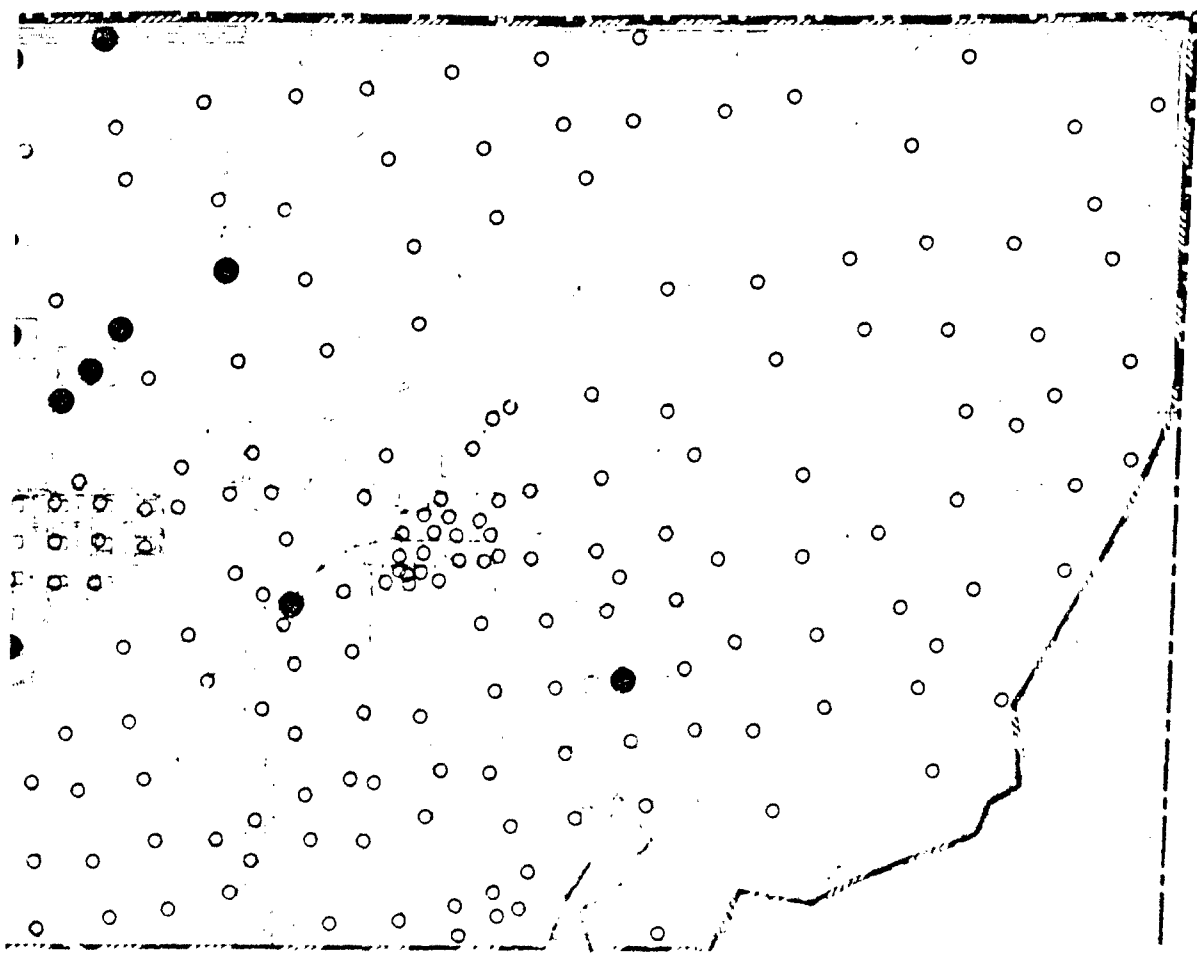
Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

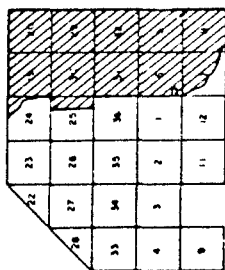


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

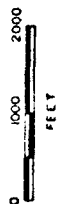
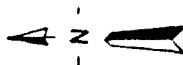




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.1-43

ICP Metals in Soils in the
2-5 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

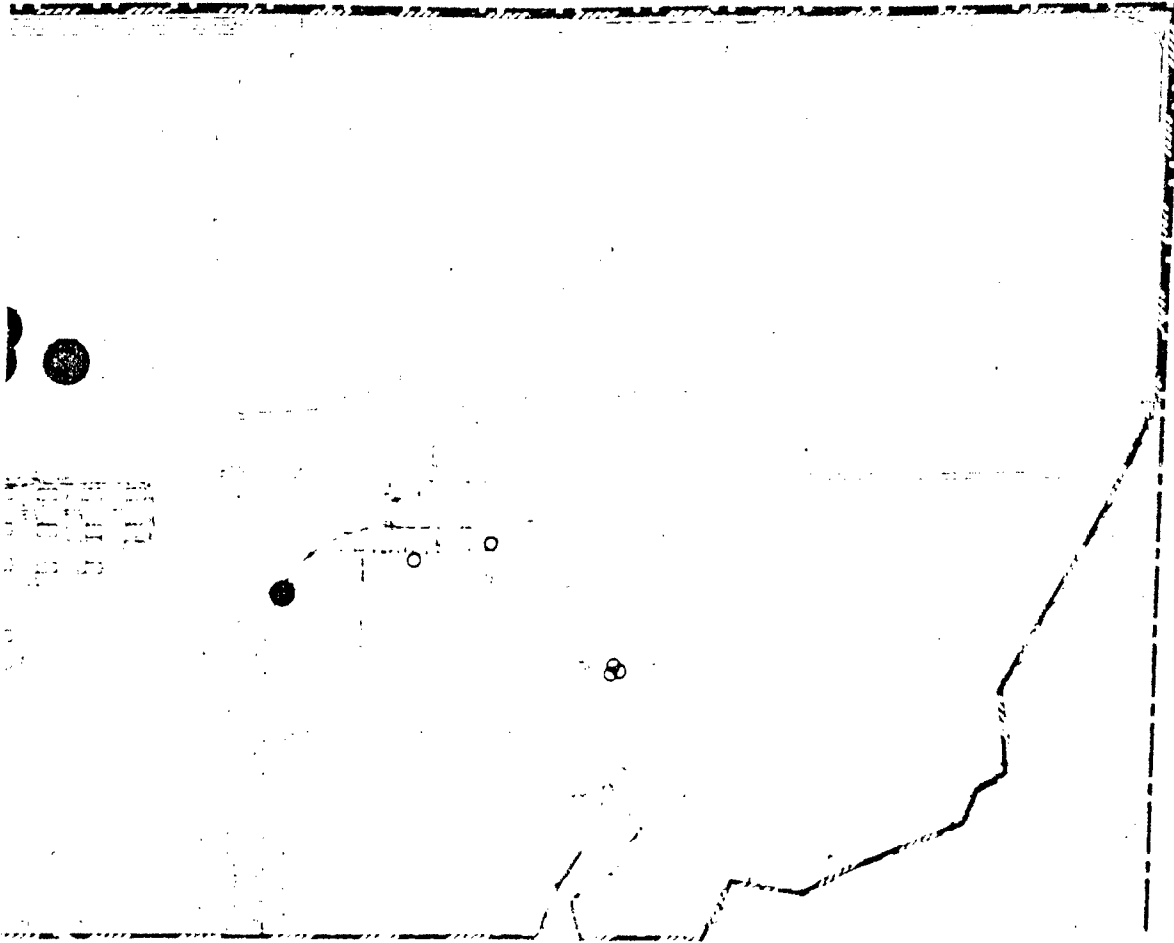
LEGEND

Improved road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Section number
Structure	Storage pond
Eastern Study Area boundary	Arsenal boundary
State Plane grid	Fence
Berms or soil mounds	FSA-15
	Subarea boundary

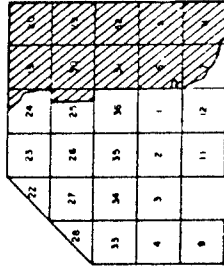
ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/g)

Cd	Cr	Cu	Pb	Zn
BCRL-2.0	BCRL-40	BCRL-35	BCRL-40	BCRL-80
>2.0-10	>40-100	>35-100	>40-100	>80-1,000
>10-100	>100-1,000	>100-1,000	>100-1,000	>1,000-10,000
>100	>1,000	>1,000	>1,000	>10,000

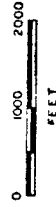
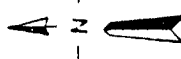




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

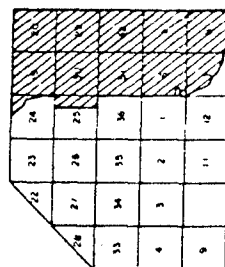
FIGURE -ESA 2.1-44

ICP Metals in Soils in the
5-20 ft. Depth Interval

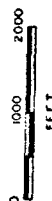
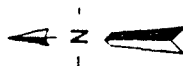
Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated



EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



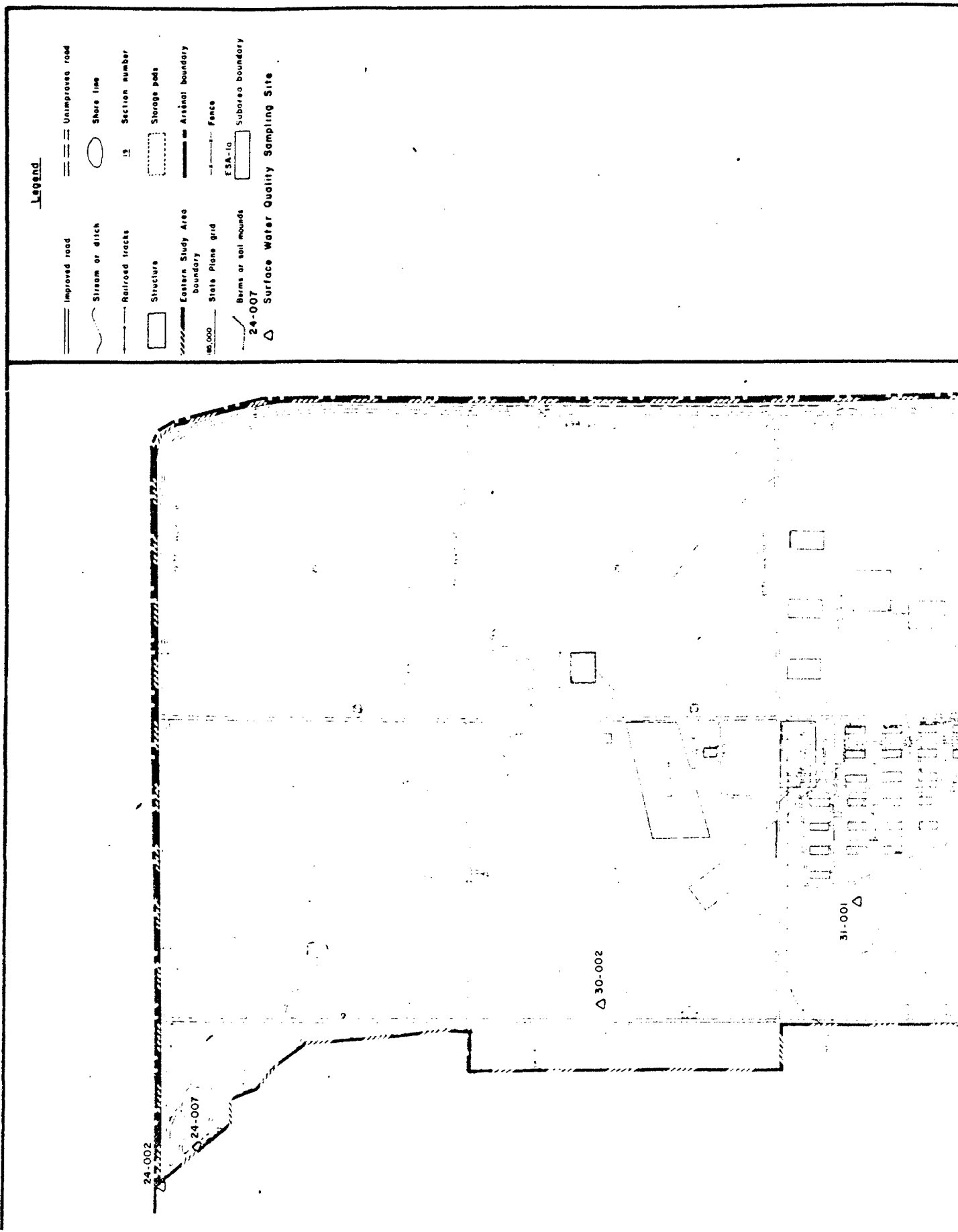
Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE -ESA 2.1-45

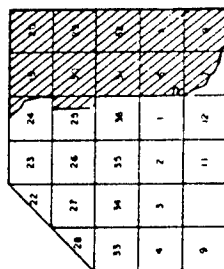
ICP Metals in Soils in the
> 20 ft. Depth Interval

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

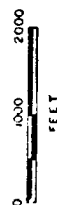
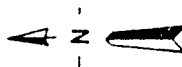




**EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL**



1" = 4 MILES



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

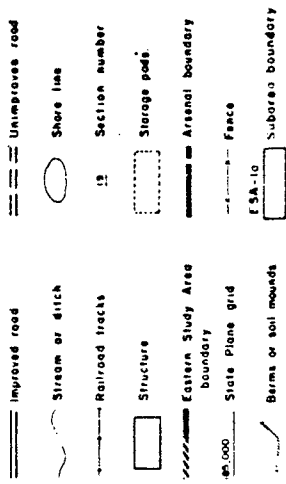
FIGURE ESA 2.2-1

Surface Water Sampling Locations
in the Eastern Study Area

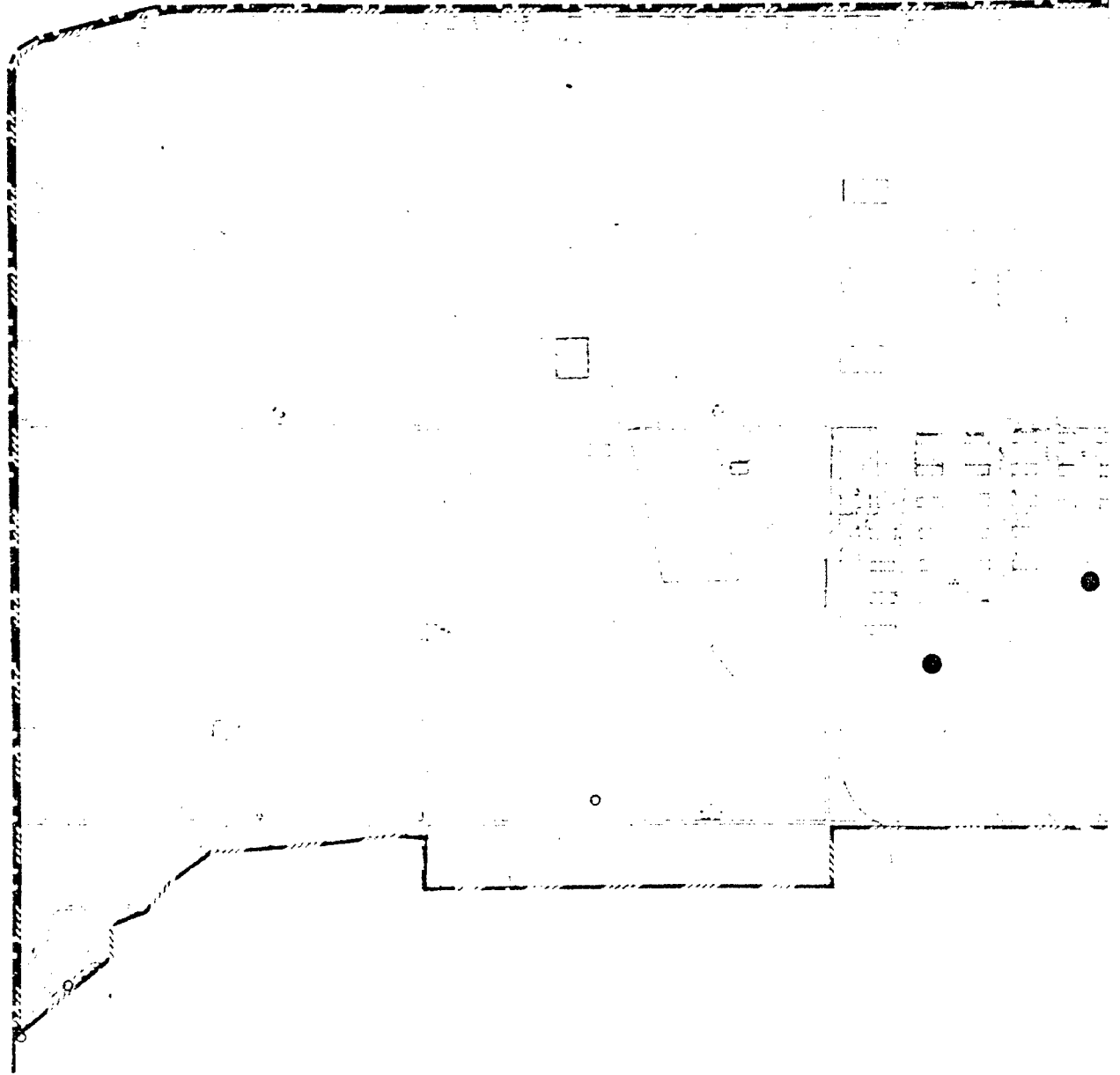
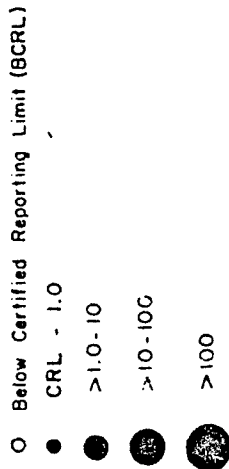
Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

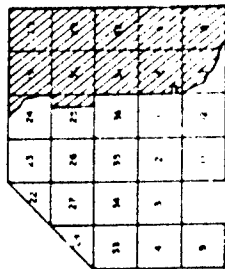
Legend



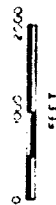
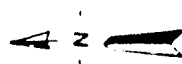
ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)



EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



4 MILES



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Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.2-2

Volatile Halogenated Organics in Surface
Water

Rocky Mountain Arsenal
Prepared by Ebasco Services Incorporated

Legend



ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

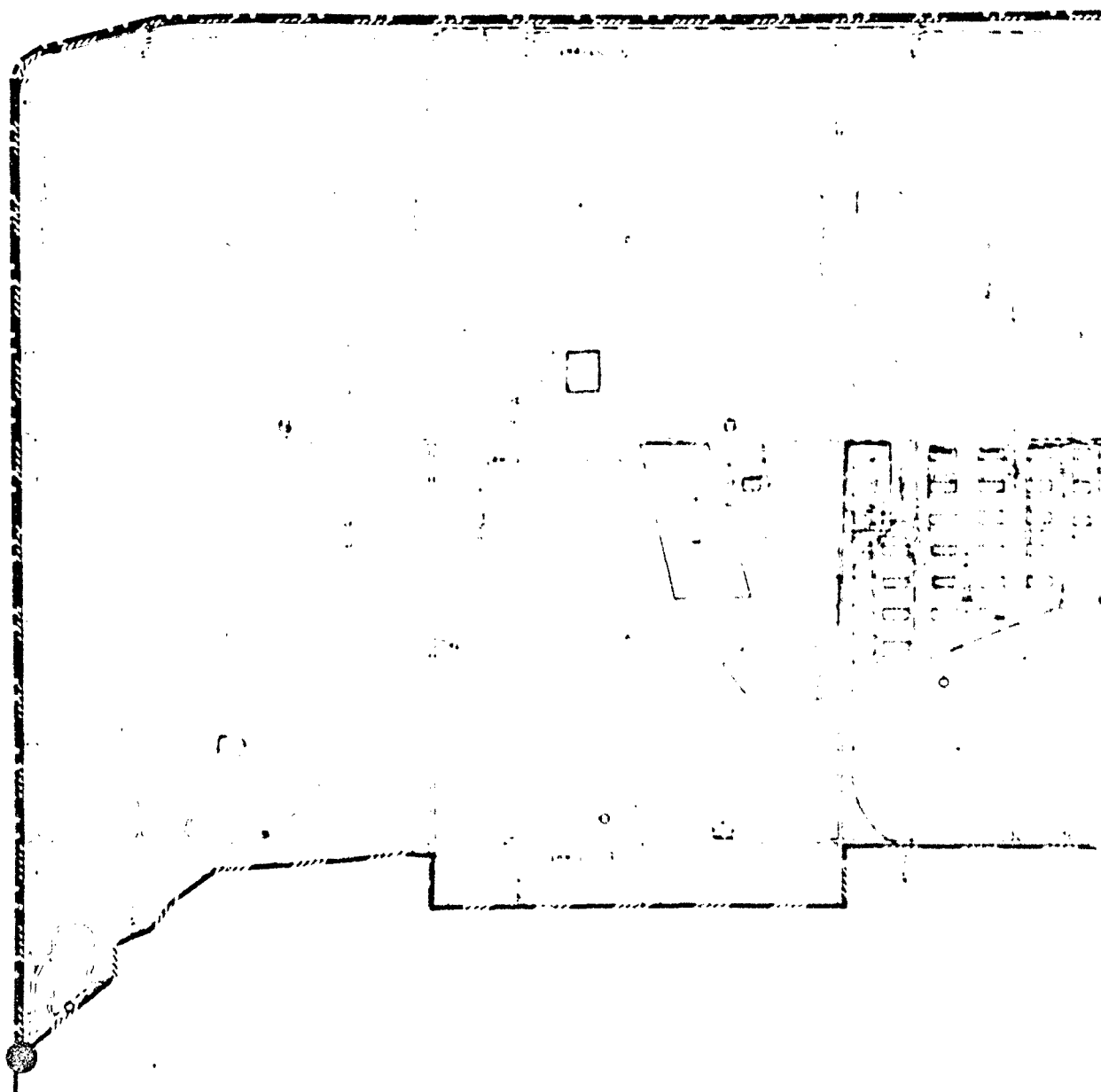
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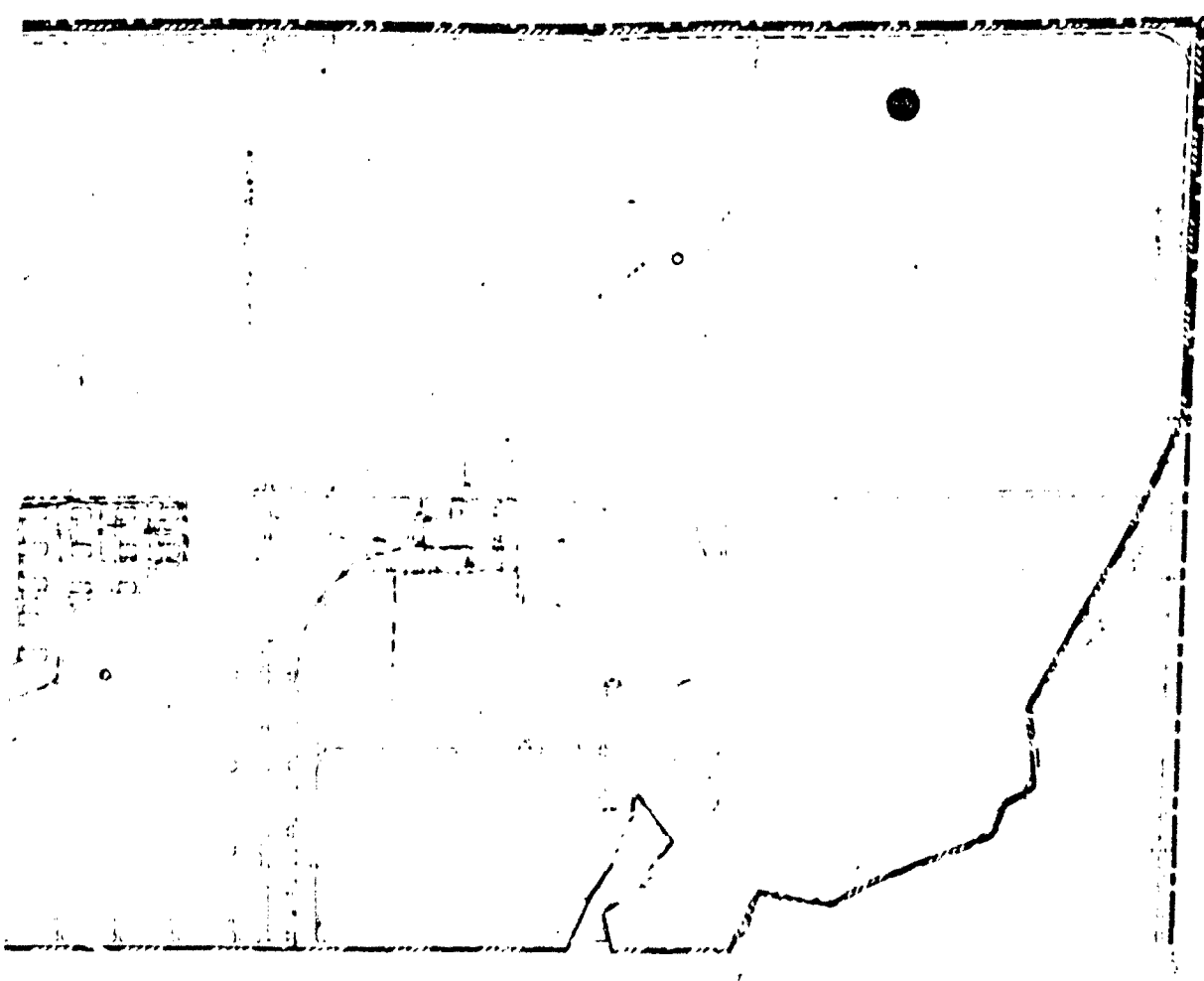
● CRL - 1.0

● > 1.0 - 10

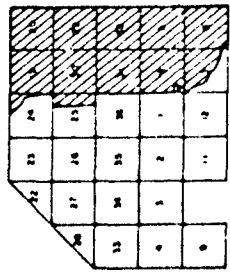
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● > 100

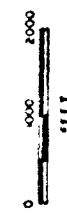
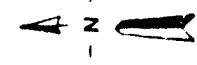




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



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Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.2-3

Organophosphorous Compounds, GB-Agent
Related in Surface Water

Rocky Mountain Arsenal
Prepared by Edasco Services Incorporated

Legend

Improved road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Section number
Structure	Storage pads
Eastern Study Area boundary	Armed Boundary
State Plane Grid	Fence
Berms or spill mounds	FSA-10
	Subarea boundary

ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

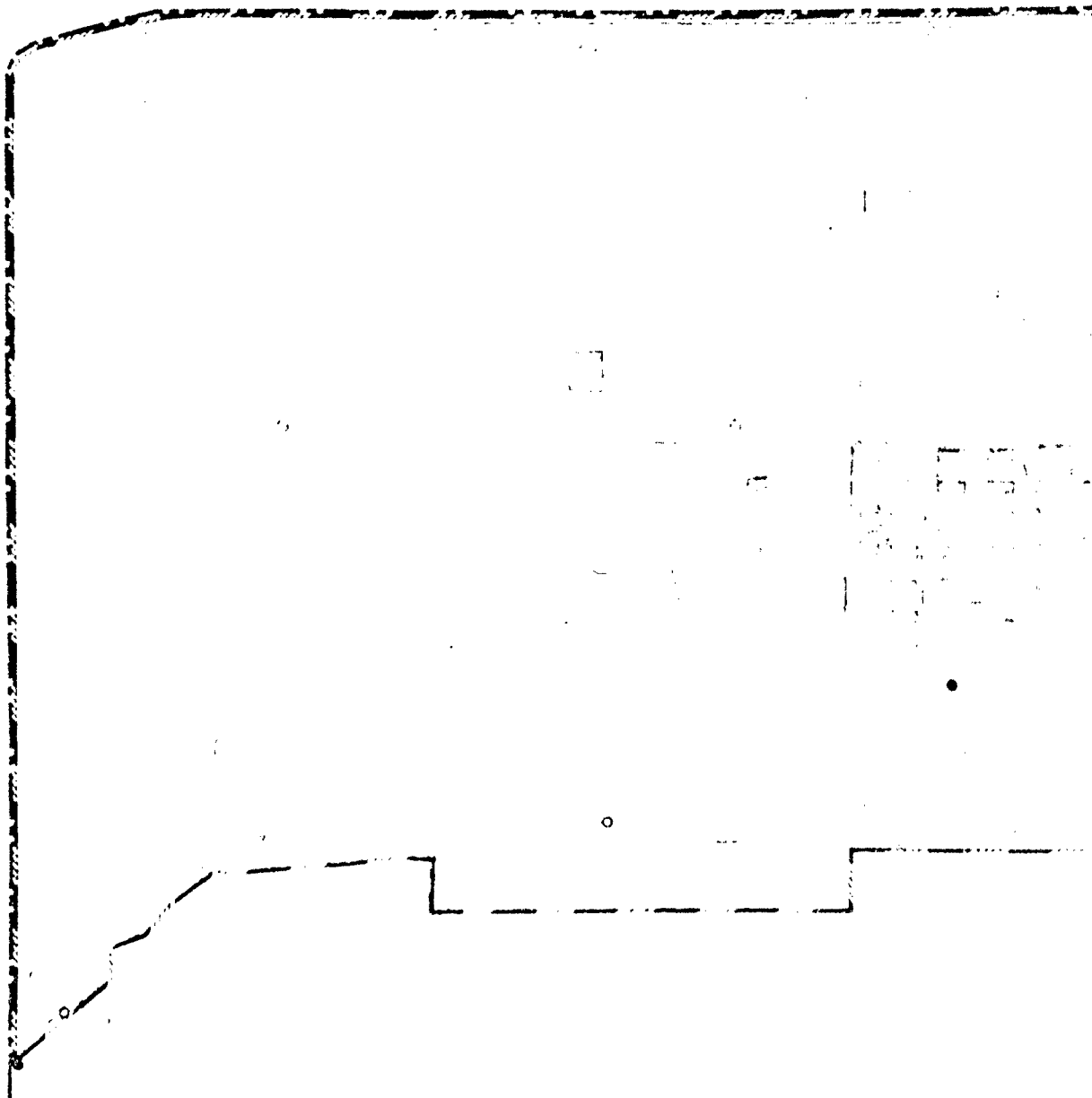
○ Below Certified Reporting Limit (BCRL)

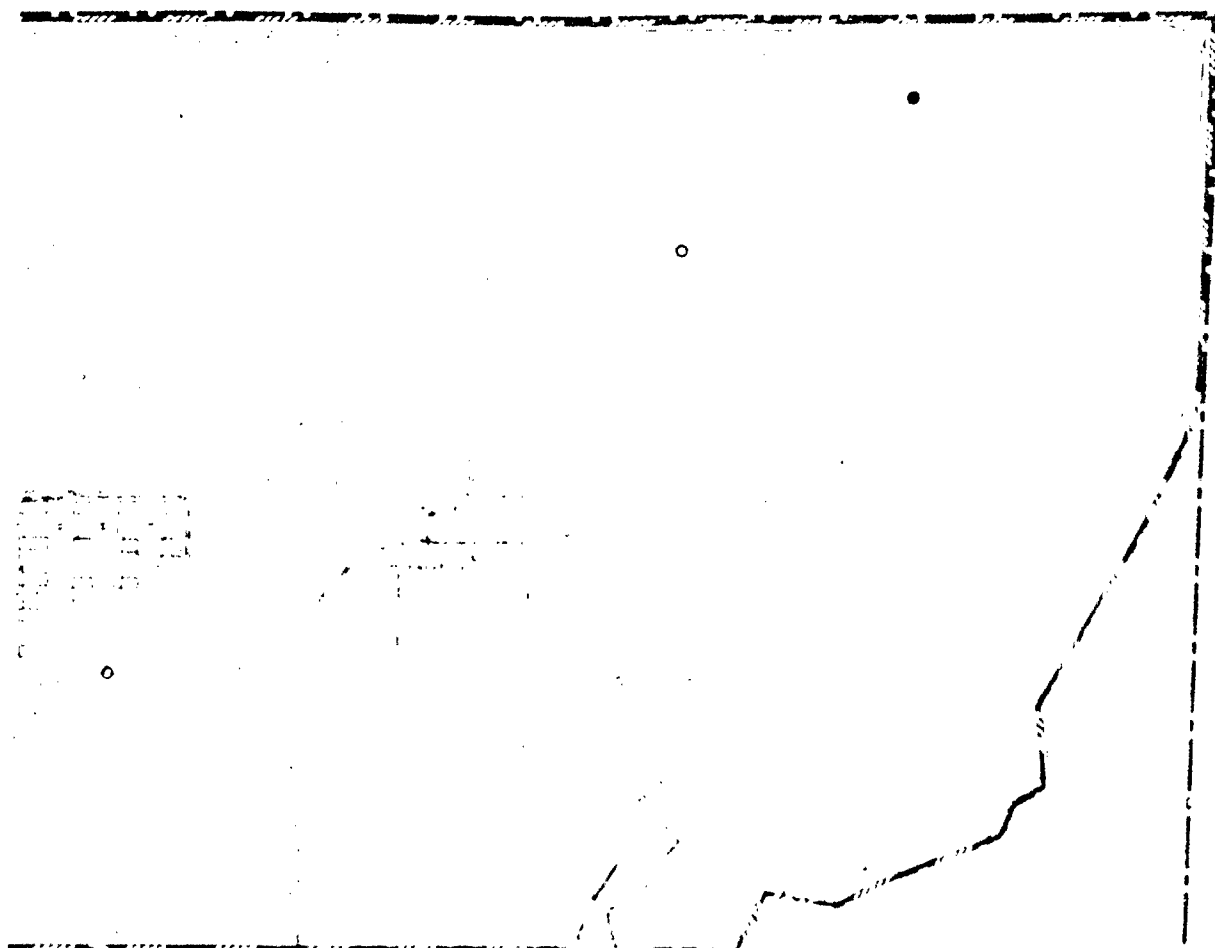
● CRL - 1.0

● >1.0-10

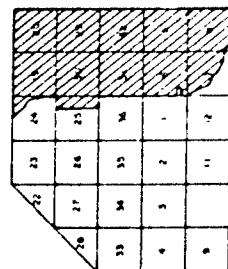
● >10-100

● >100

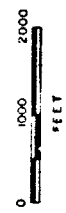
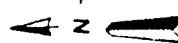




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



0 - 4 MILES



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE - ESA 2.2-4

Organochlorine Pesticides in Surface Water

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

- | | |
|-----------------------------|-------------------|
| Improved road | Unimproved road |
| Stream or ditch | Shore line |
| Railroad tracks | Section number |
| Structure | Storage pads |
| Eastern Study Area boundary | Airfield boundary |
| 40,000 | Fence |
| State Plane grid | ESA-10 |
| Barms or soil mounds | Subarea boundary |

ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/l)

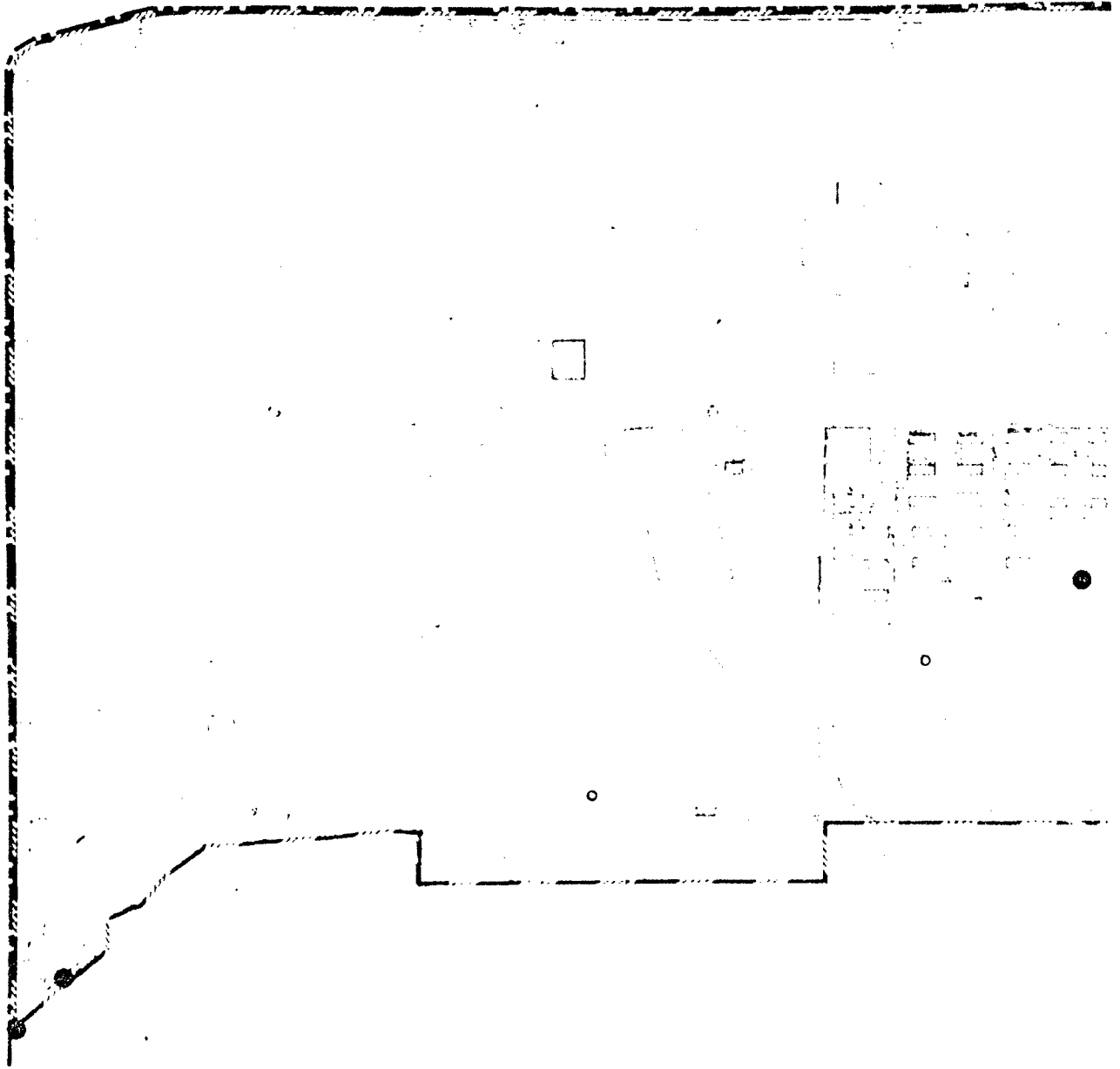
○ Below Certified Reporting Limit (BCRL)

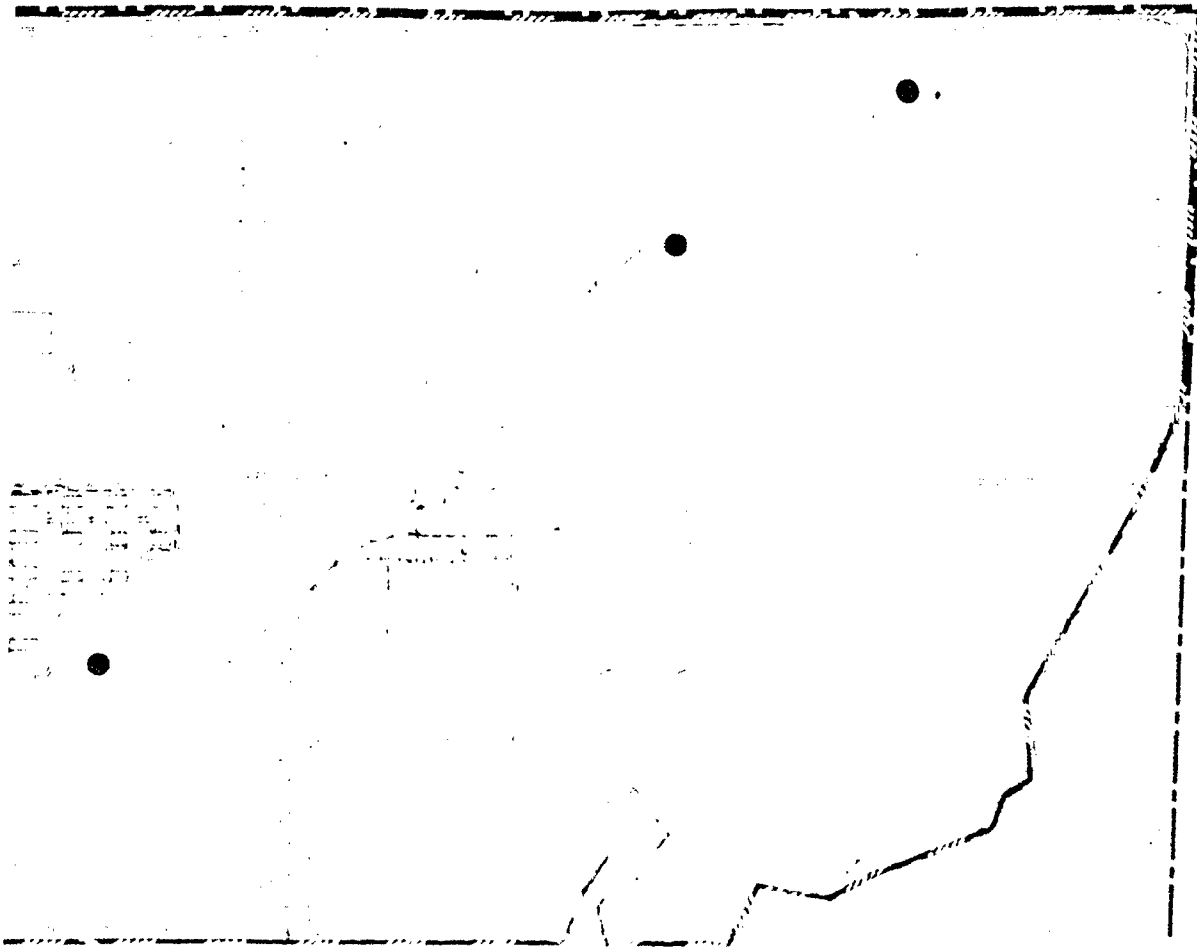
● CRL - 1.0

● > 1.0 - 10

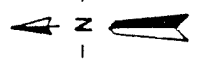
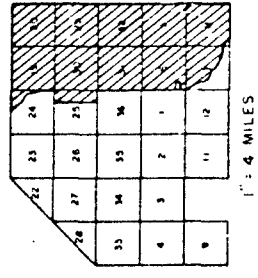
● > 10 - 100

● > 100





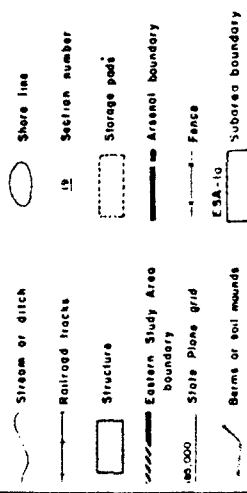
EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



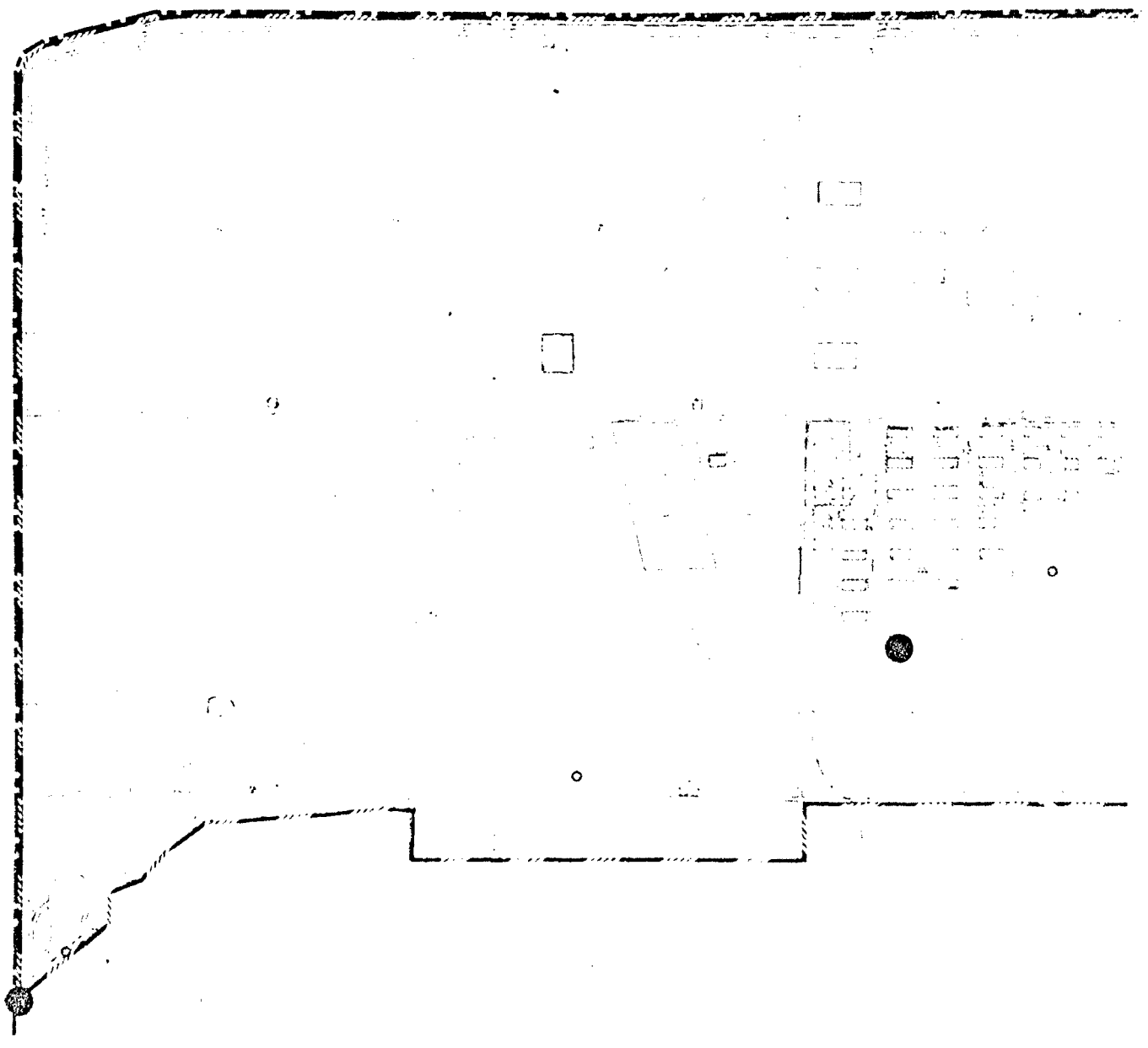
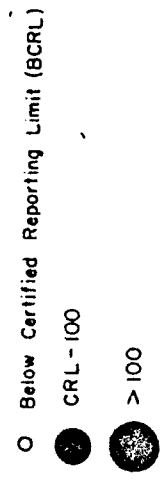
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

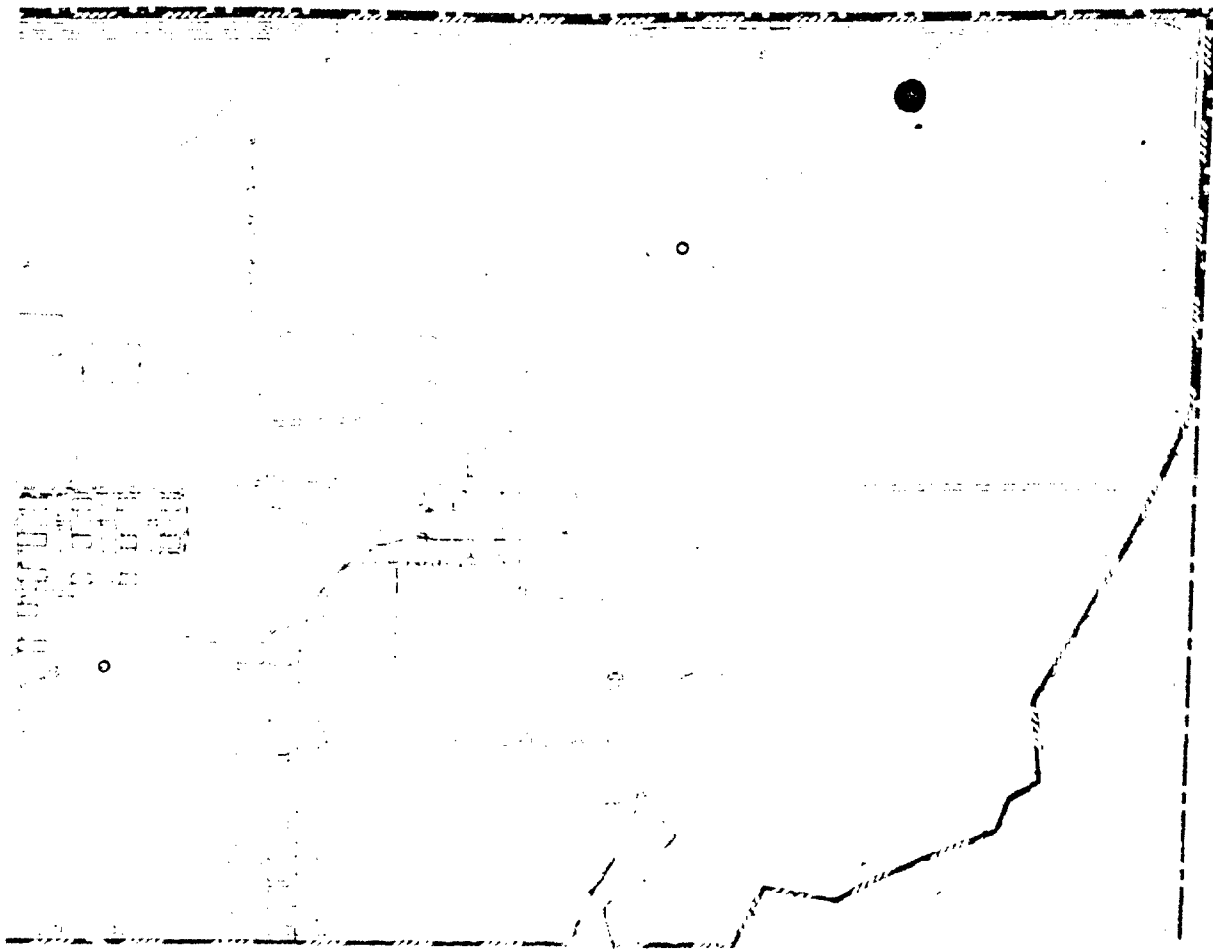
FIGURE ESA 2.2-5
Arsenic in Surface Water

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

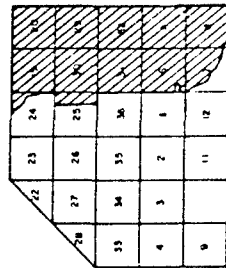


ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/l)

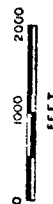
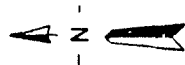




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



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Rocky Mountain Arsenal Cleanup

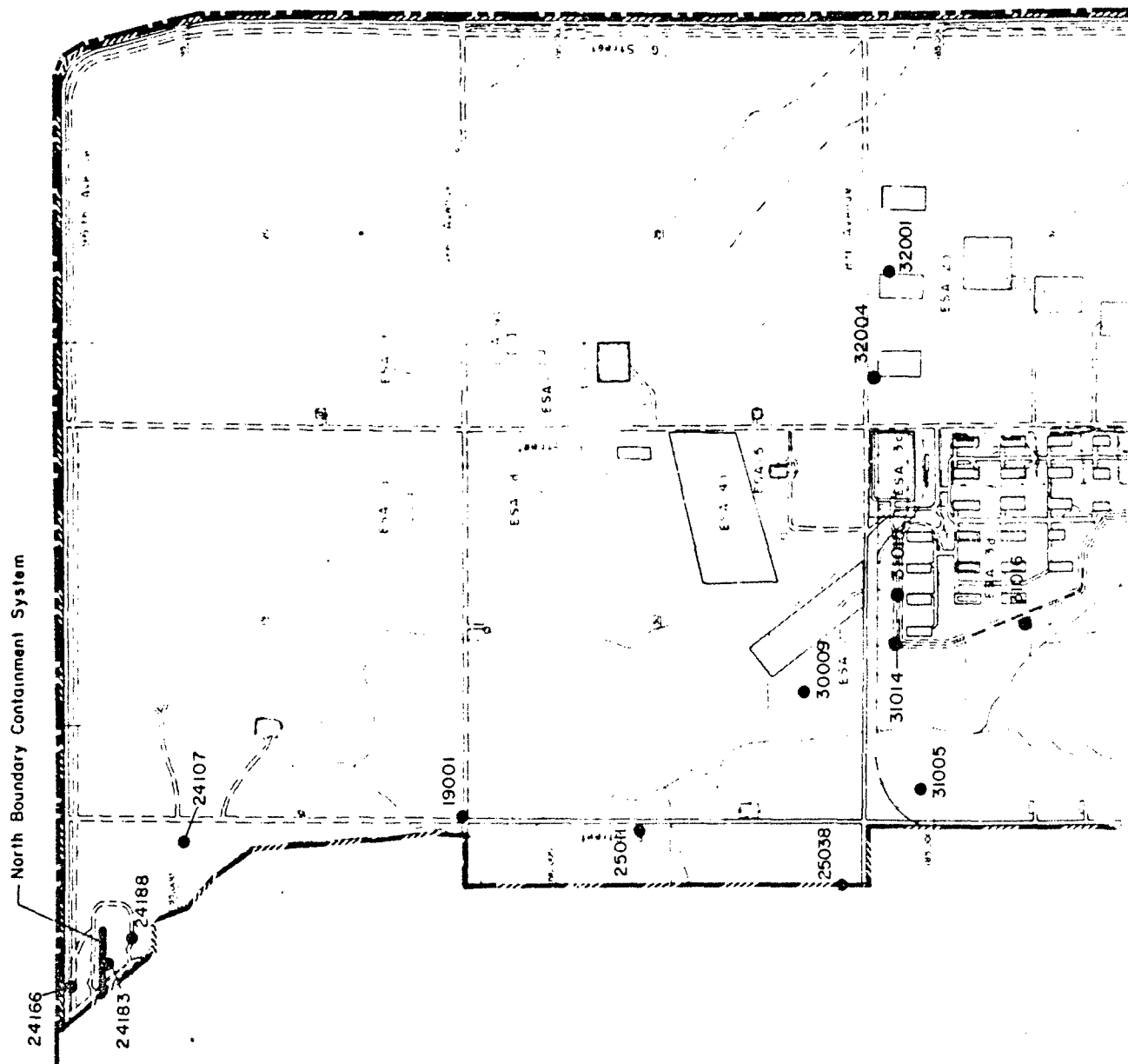
FIGURE ESA 2.2-6
ICP Metals in Surface Water

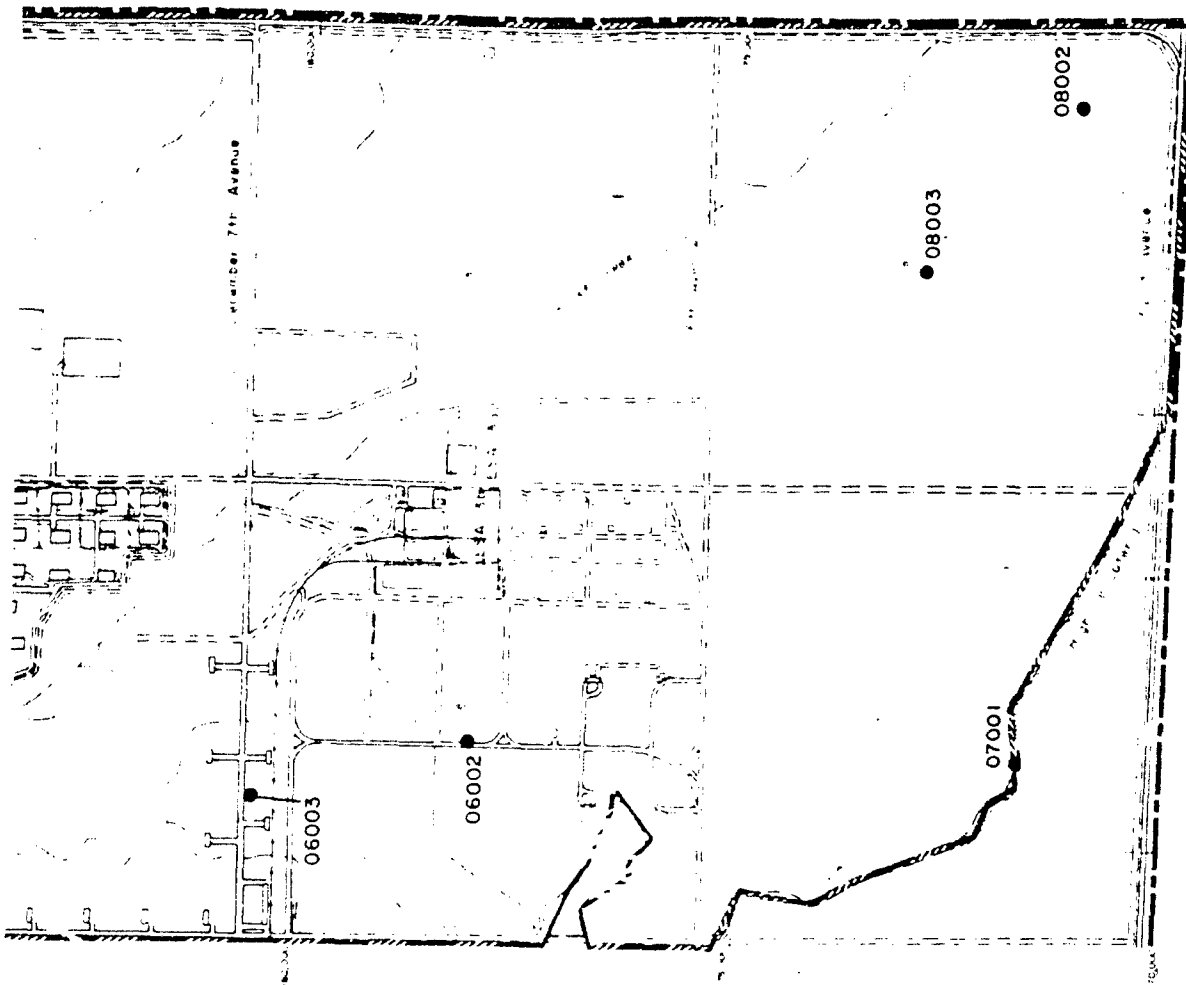
Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

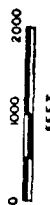
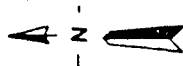
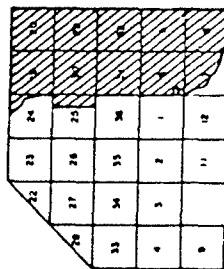
- == Improved road
- == Unimproved road
- ~ Stream or ditch
- Shore line
- Railroad tracks
- 12 Section number
- Structure
- Storage pad
- ▨ Eastern Study Area boundary
- ▨ Airfield boundary
- ▨ State Plane grid
- Fence
- ES-10
- Berms or soil mounds
- Subarea boundary

32001 ● Alluvial Well Sampling Location





**EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL**



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.3-1
Alluvial Well Groundwater Sampling
Locations in the Eastern Study Area

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

==	Improved road	==	Unimproved road
~	Stream or ditch	○	Shore line
---	Railroad tracks	12	Section number
□	Structure	□	Storage pile
---	Eastern Study Area boundary	---	Aerial boundary
400,000	State Plane grid	---	Fence
---	Burns or soil mounds	ESA-10	Subarea boundary

ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

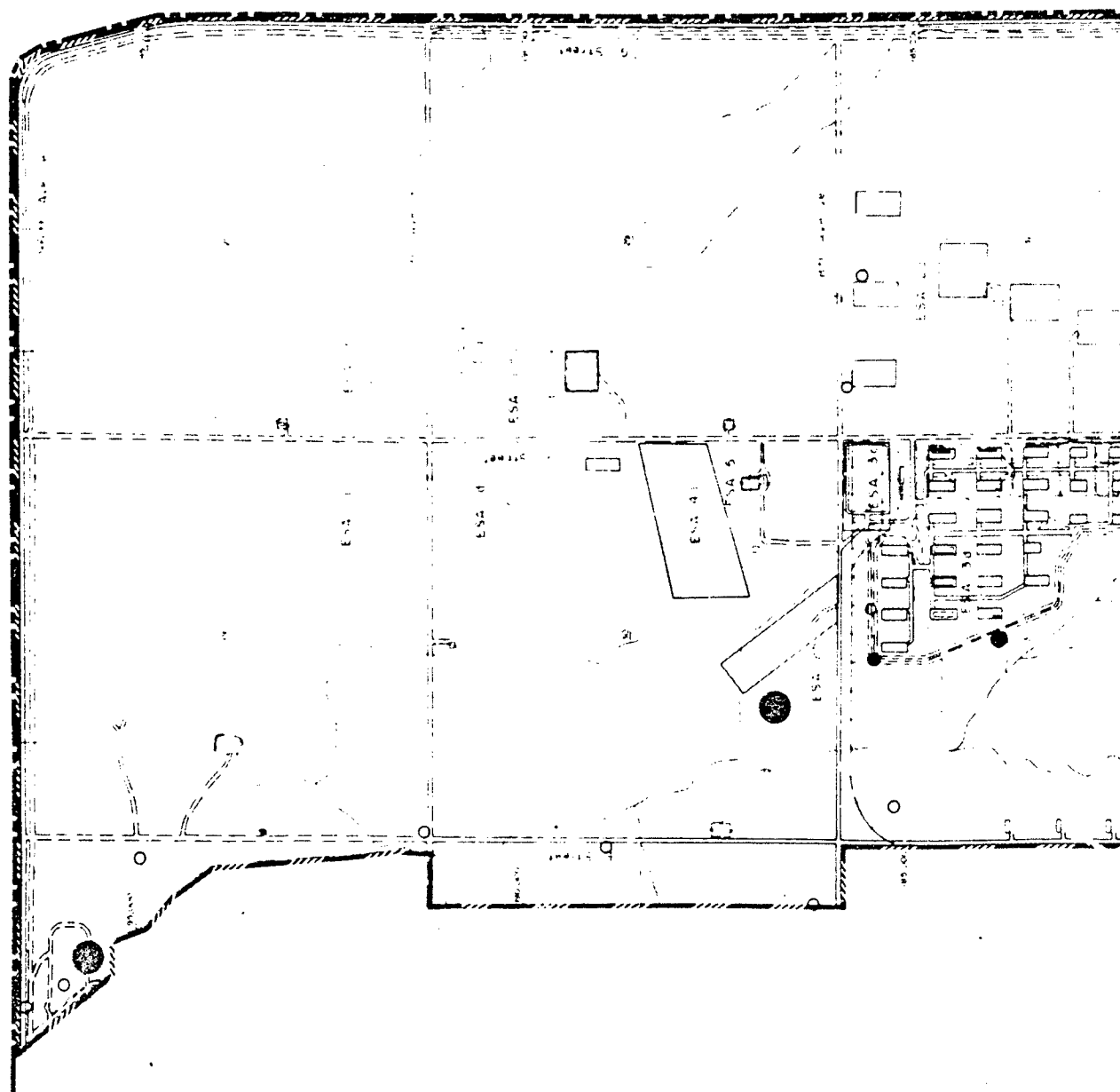
○ Below Certified Reporting Limit (BCRL)

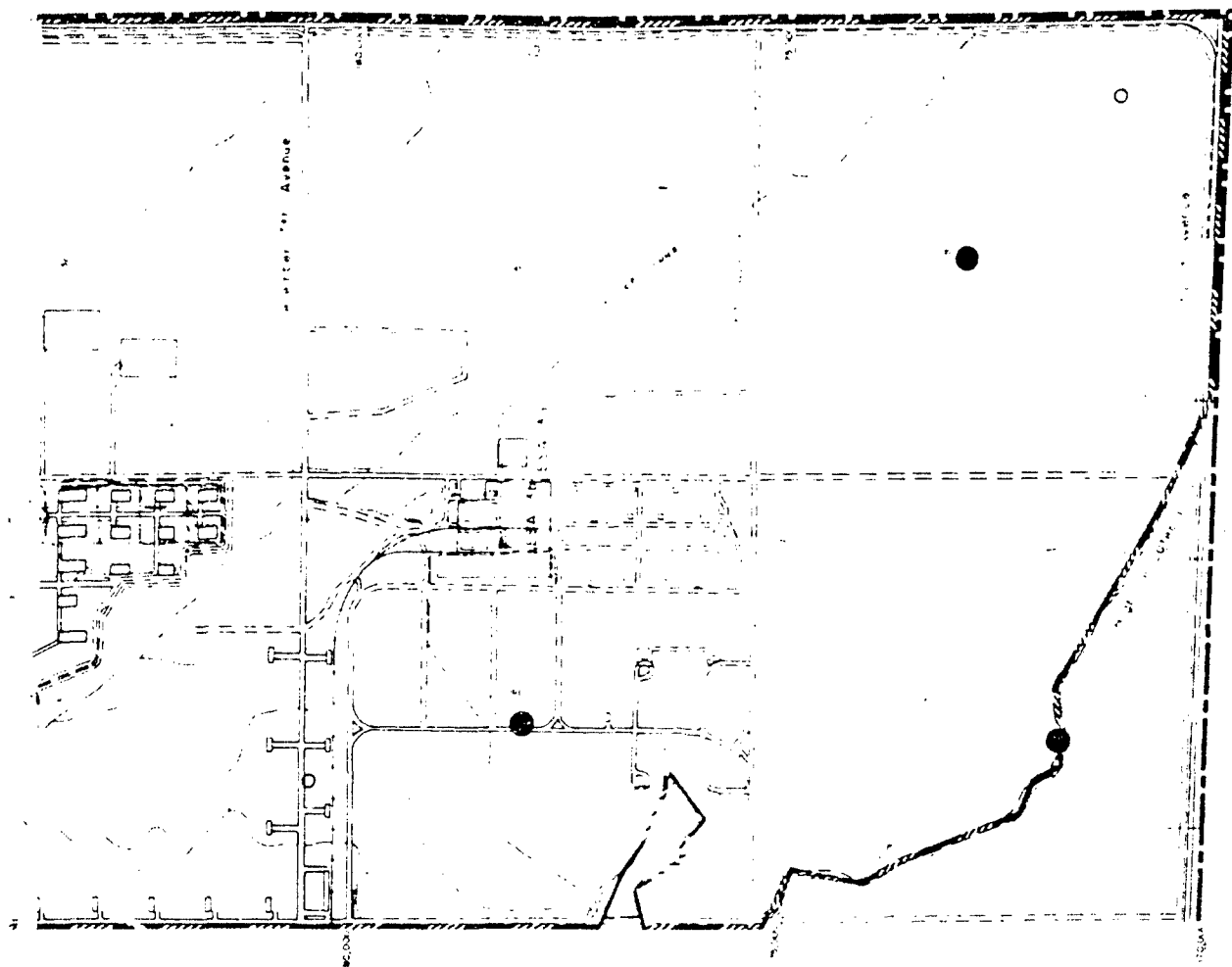
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● > 1.0 - 10

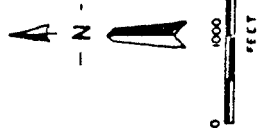
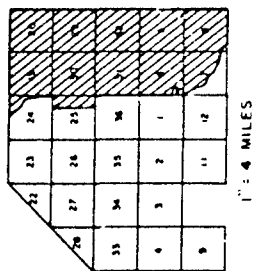
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● > 100





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL

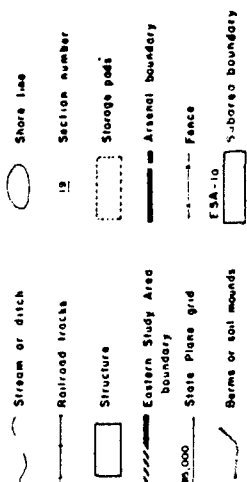


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FIGURE ESA 2.3 - 2
Volatile Halogenated Organics in the
Alluvial Aquifer

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated



ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

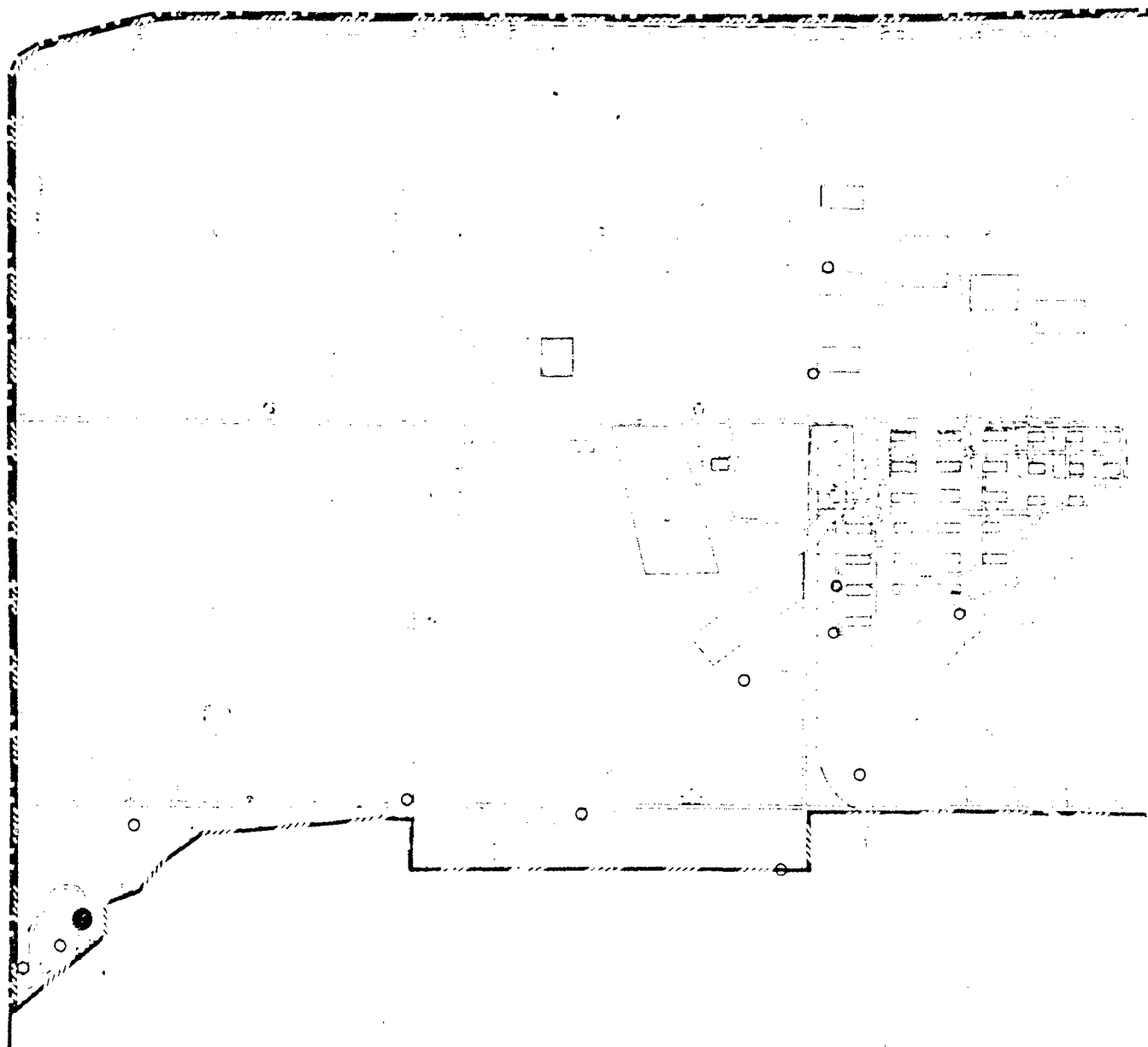
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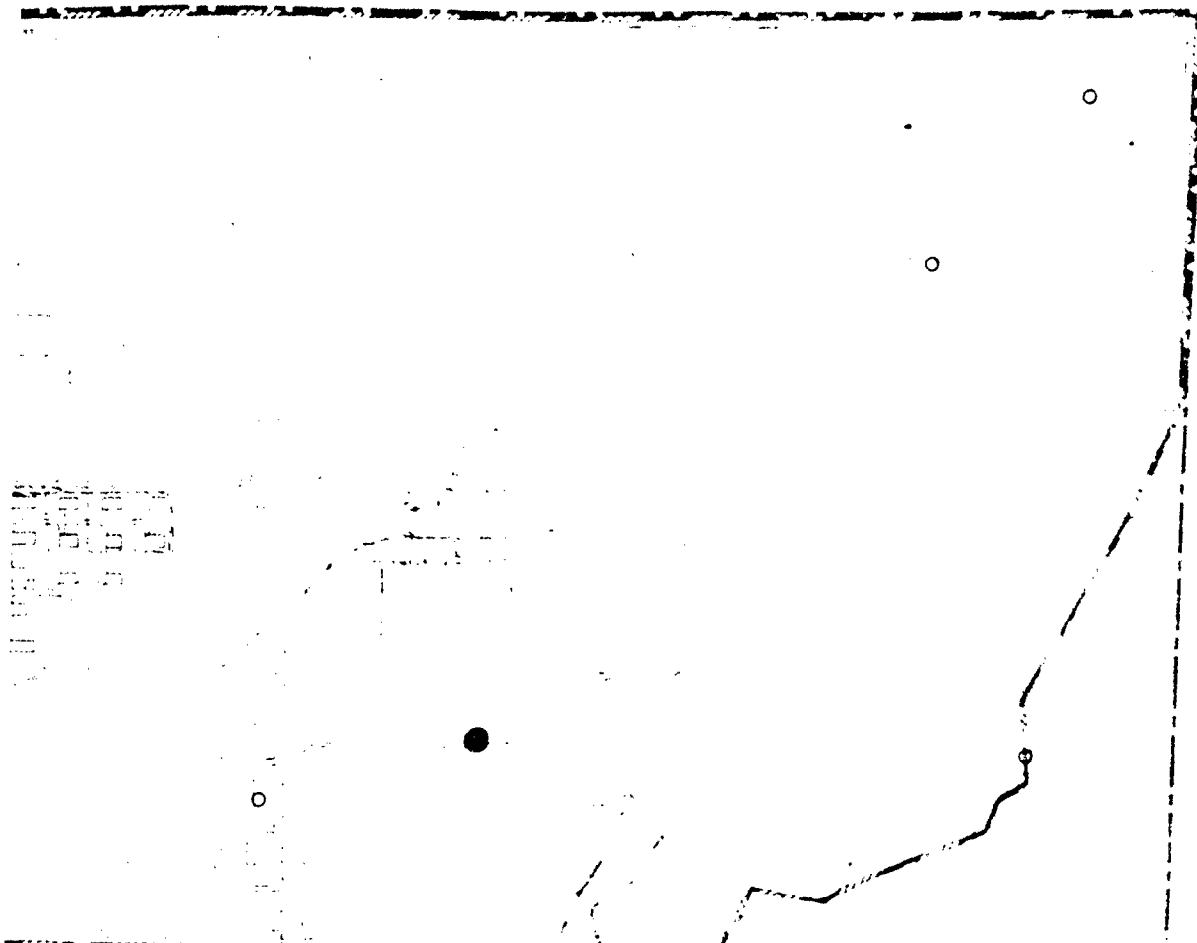
● CRL - 1.0

● > 1.0-10

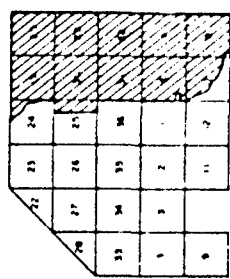
● > 10-100

● > 100

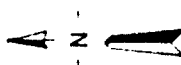




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



0.4 MILES



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Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2-3-3

Volatile Aromatic Organics in the
Alluvial Aquifer

Rocky Mountain Arsenal

Prepared by Ebasco Services Incorporated

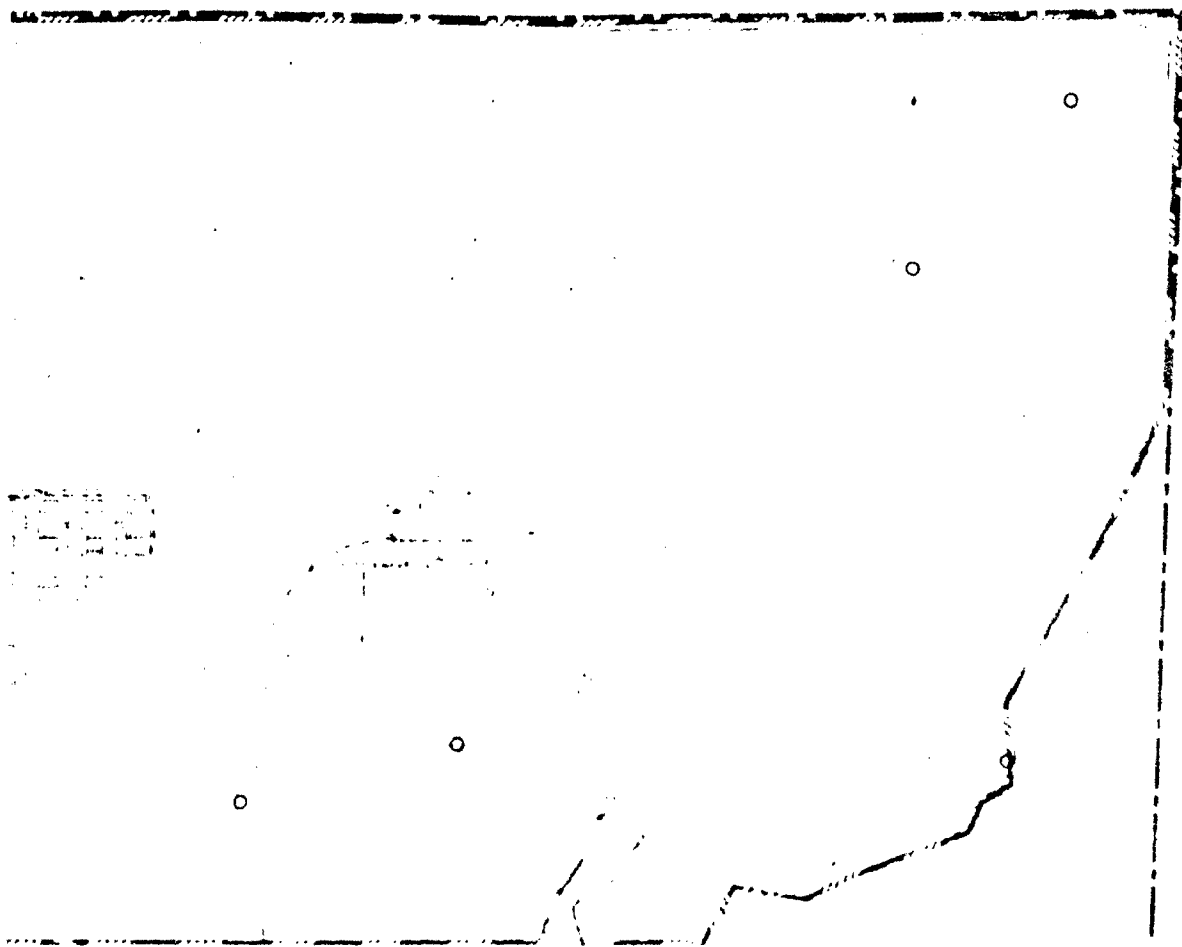
Legend

- Improved road
- Stream or ditch
- Railroad tracks
- Structure
- Eastern Study Area boundary
- Shore line
- Section number
- Storage pads
- Airfield boundary
- Fence
- ESAs
- Subarea boundary
- Barms or soil mounds

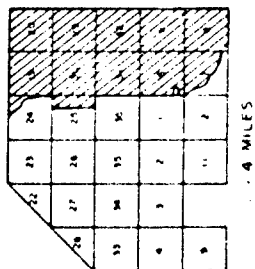
ANALYTE SAMPLE LOCATION
AND CONCENTRATION (ug/l)

- Below Certified Reporting Limit (BCRL)
- CRL - 1.0
- > 1.0 - 10
- > 10 - 100
- > 100





EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



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Rocky Mountain Arsenal Cleanup

FIGURE ESA 23-4
Organosulfur Compounds, Herbicide
Related in the Alluvial Aquifer

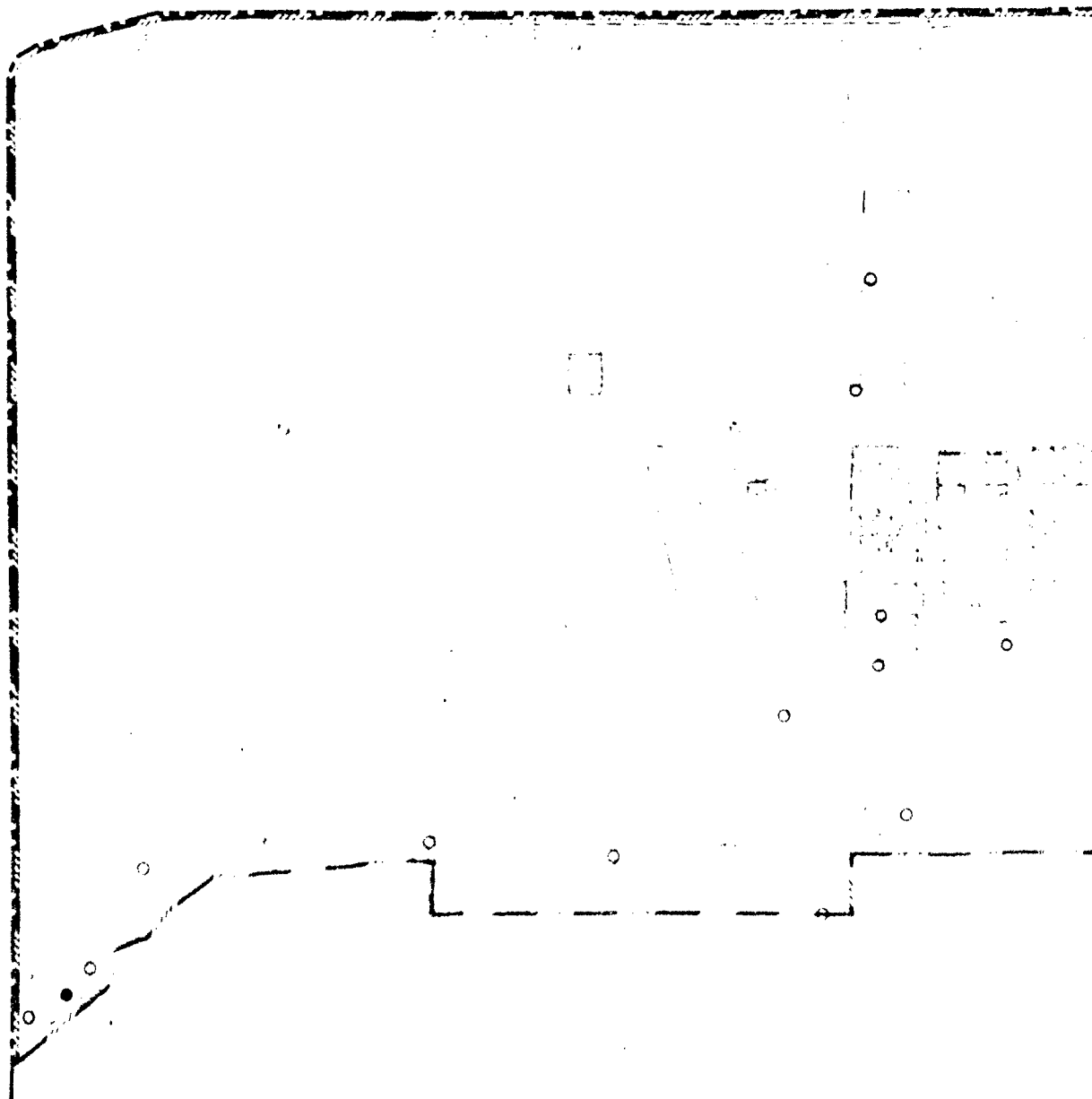
Rocky Mountain Arsenal
Prepared by Ebosco Services Incorporated

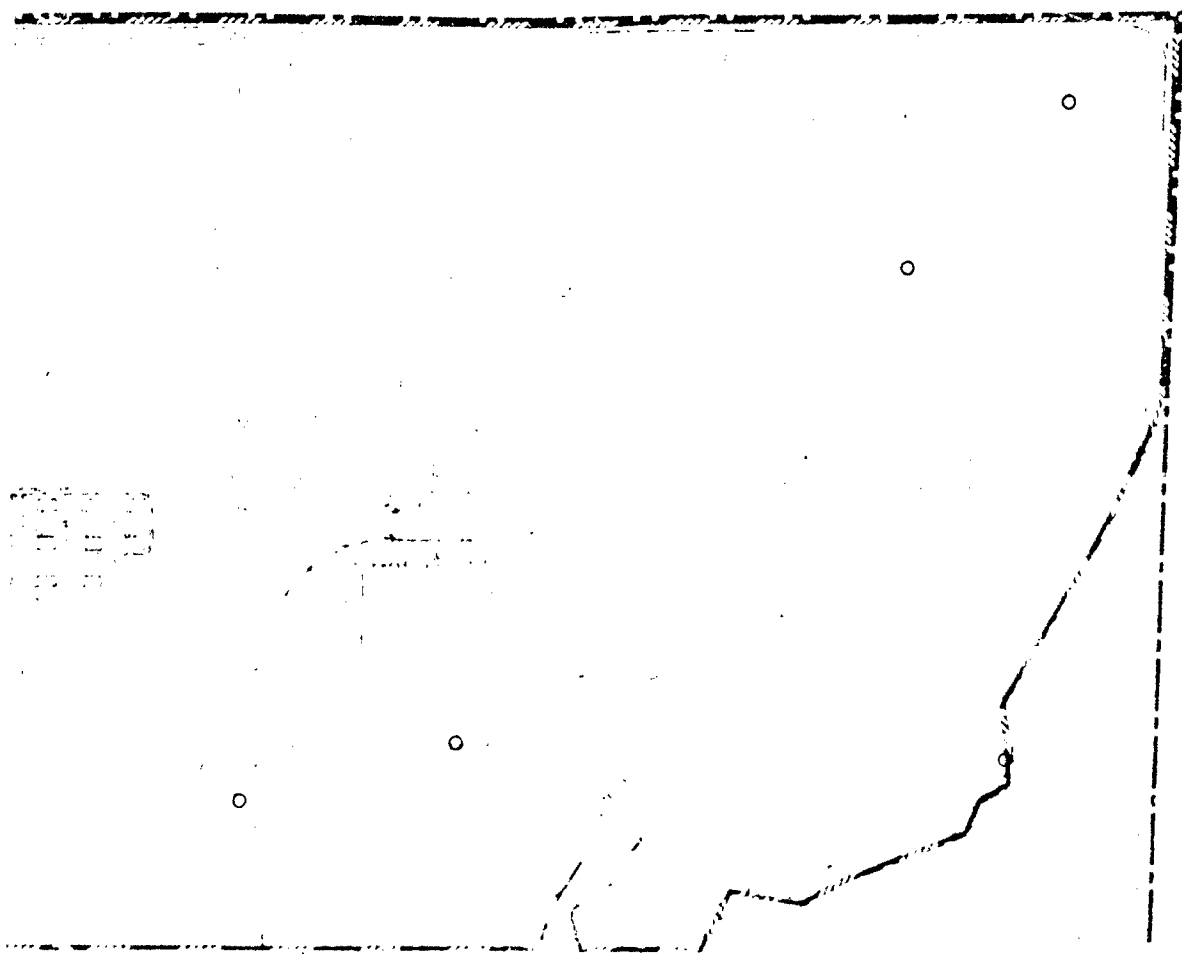
Legend

Improved road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Section number
Structure	Storage pond
Eastern Study Area boundary	Arsenal boundary
State Plane grid	Fence
Berms or soil mounds	ESB-10
	Subarea boundary

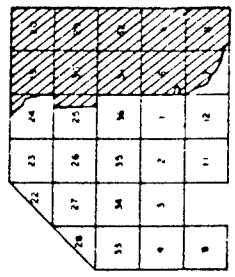
ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

○	Below Certified Reporting Limit (BCRL)
●	CRL - 1.0
●	> 1.0 - 10
●	> 10 - 100
●	> 100

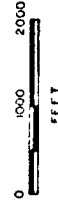
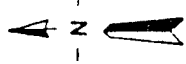




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



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Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.3-5
Dibromochloropropane in the Alluvial
Aquifer

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

Improved road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Section number
Structure	Storage pad
Eastern Study Area boundary	Armed boundary
State Plane grid	Fence
Berm or soil mounds	ESA-10
	Subarea boundary

ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

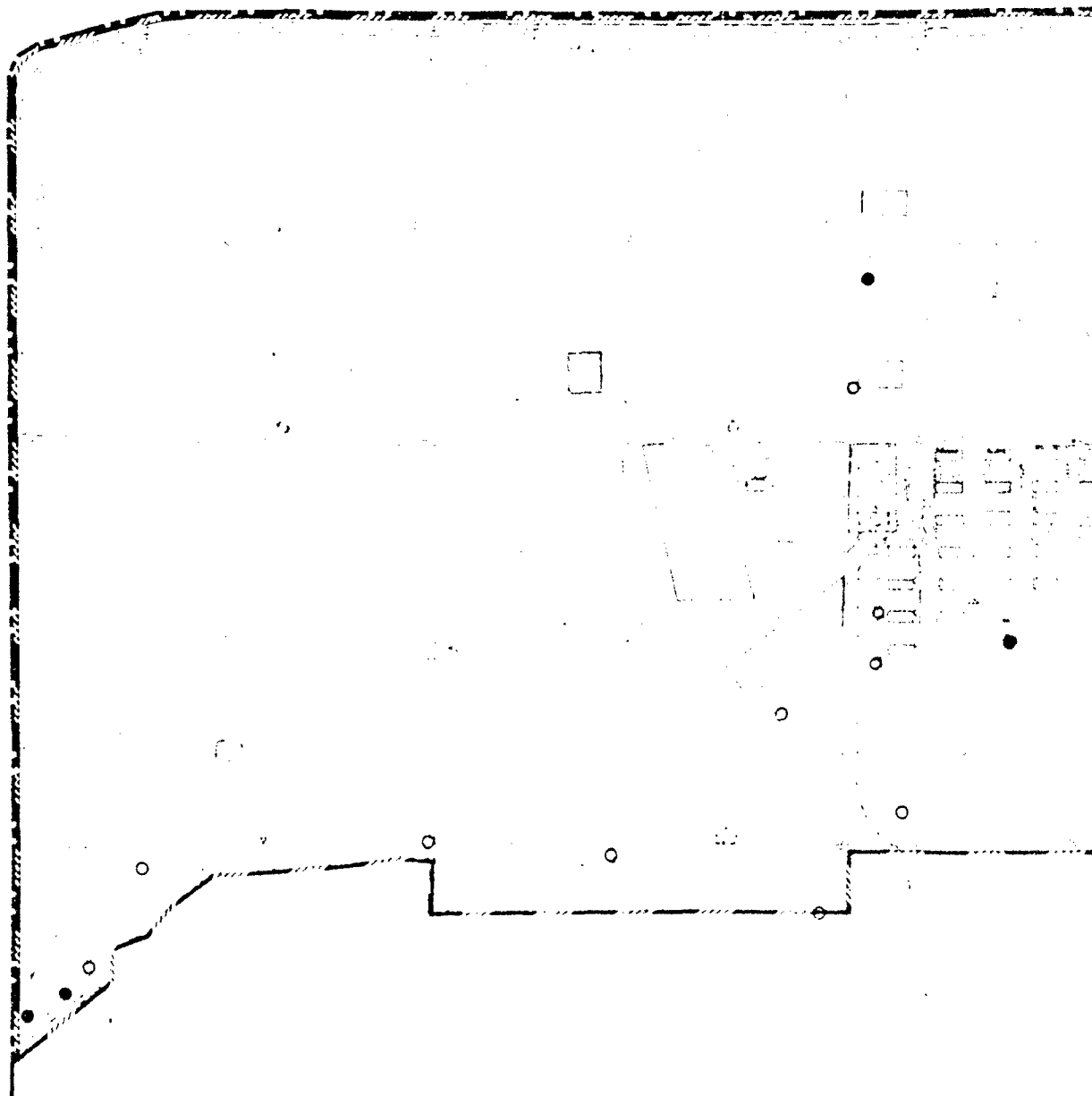
○ Below Certified Reporting Limit (BCRL)

● CRL = 1.0

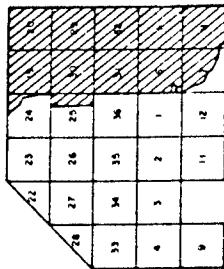
● > 1.0 - 10

● > 10 - 100

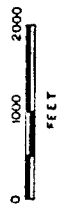
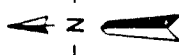
● > 100



EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



Prepared for:

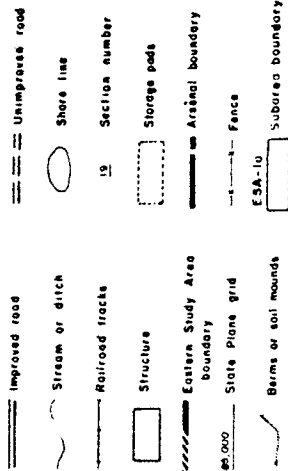
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.3-6

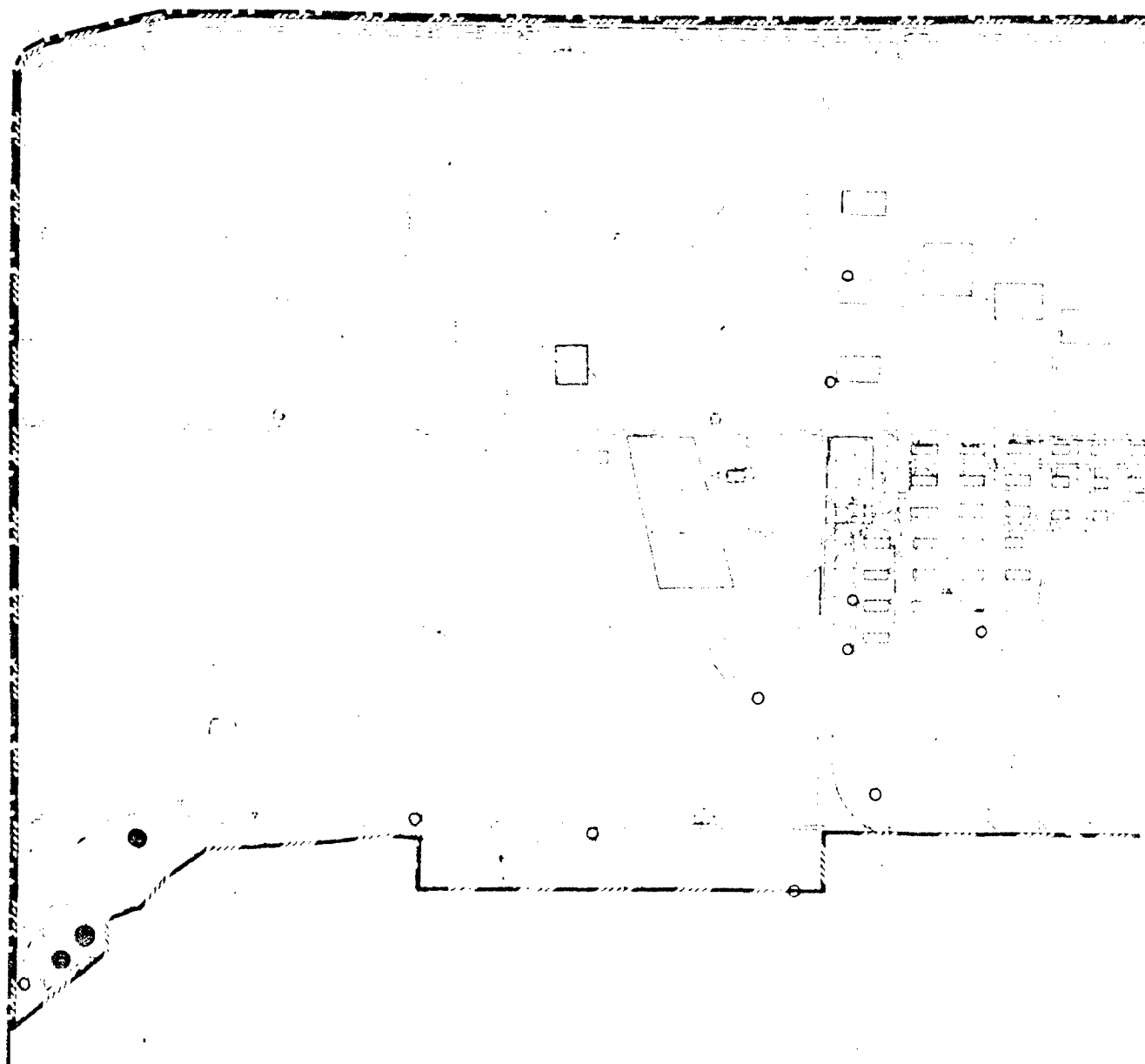
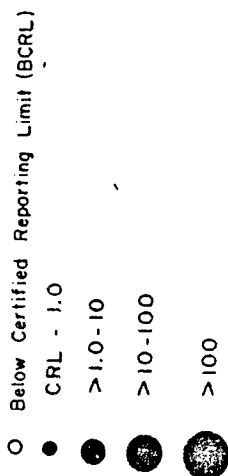
Organochlorine Pesticides in the
Alluvial Aquifer

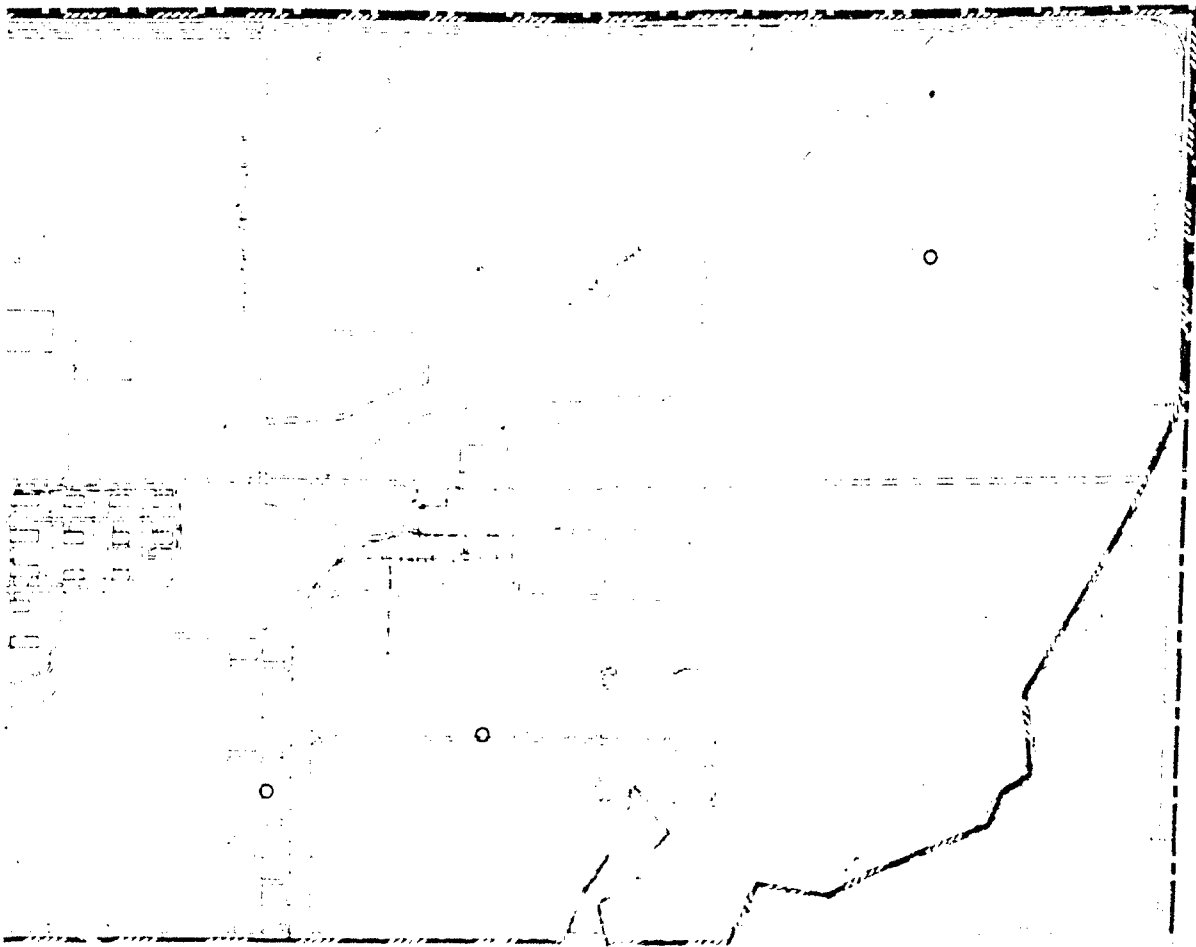
Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

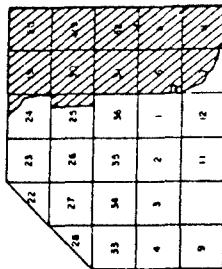


ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

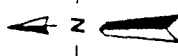




EASTERN STUDY AREA LOCATION
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



Prepared for:

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Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.3-7

Arsenic in the Alluvial Aquifer

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

Legend

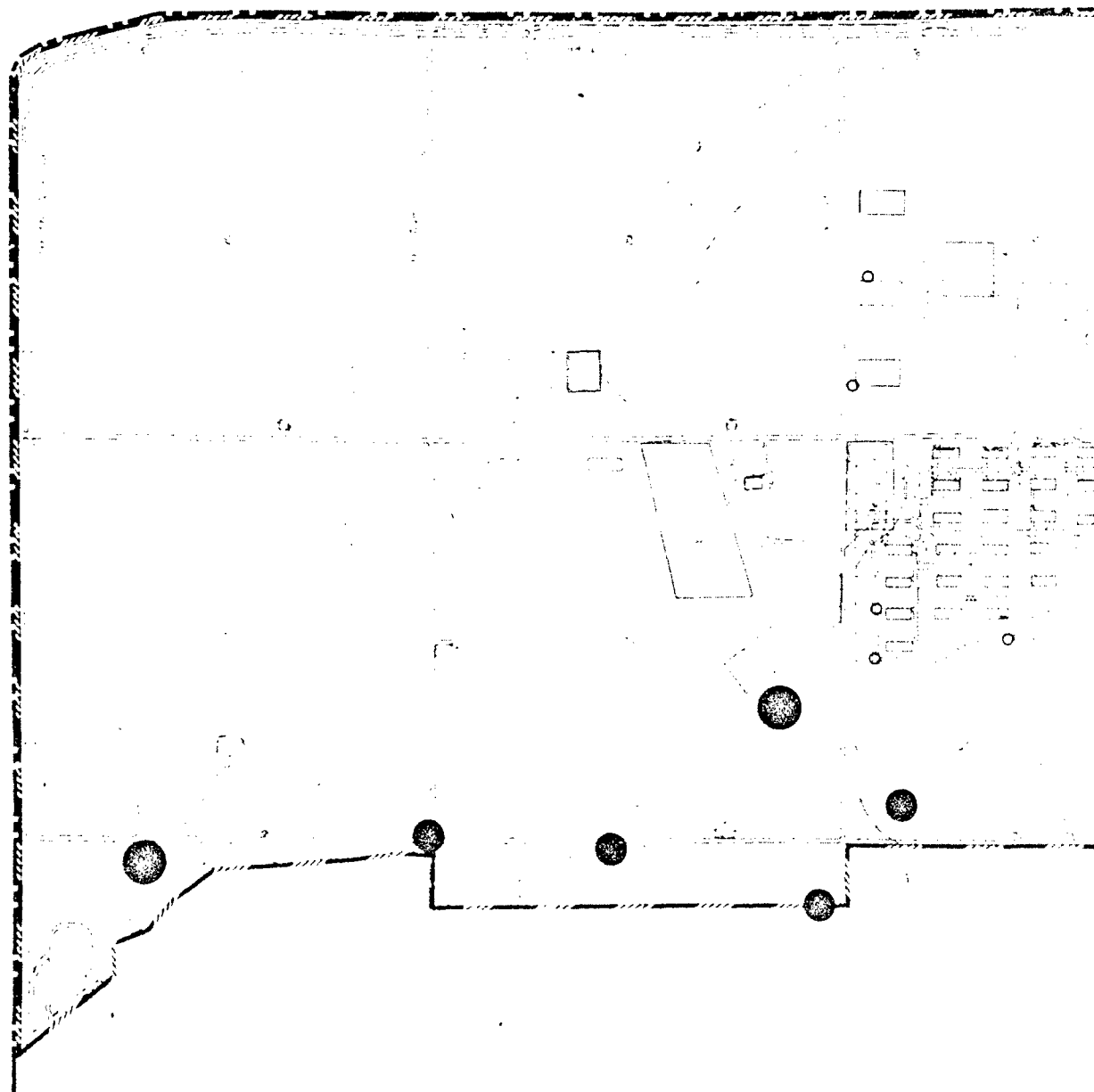
Improved road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Section number
Structure	Storage pads
Eastern Study Area boundary	Arsenal boundary
State Plane grid	Fence
Berms or soil mounds	ESA-1a
	Subarea boundary

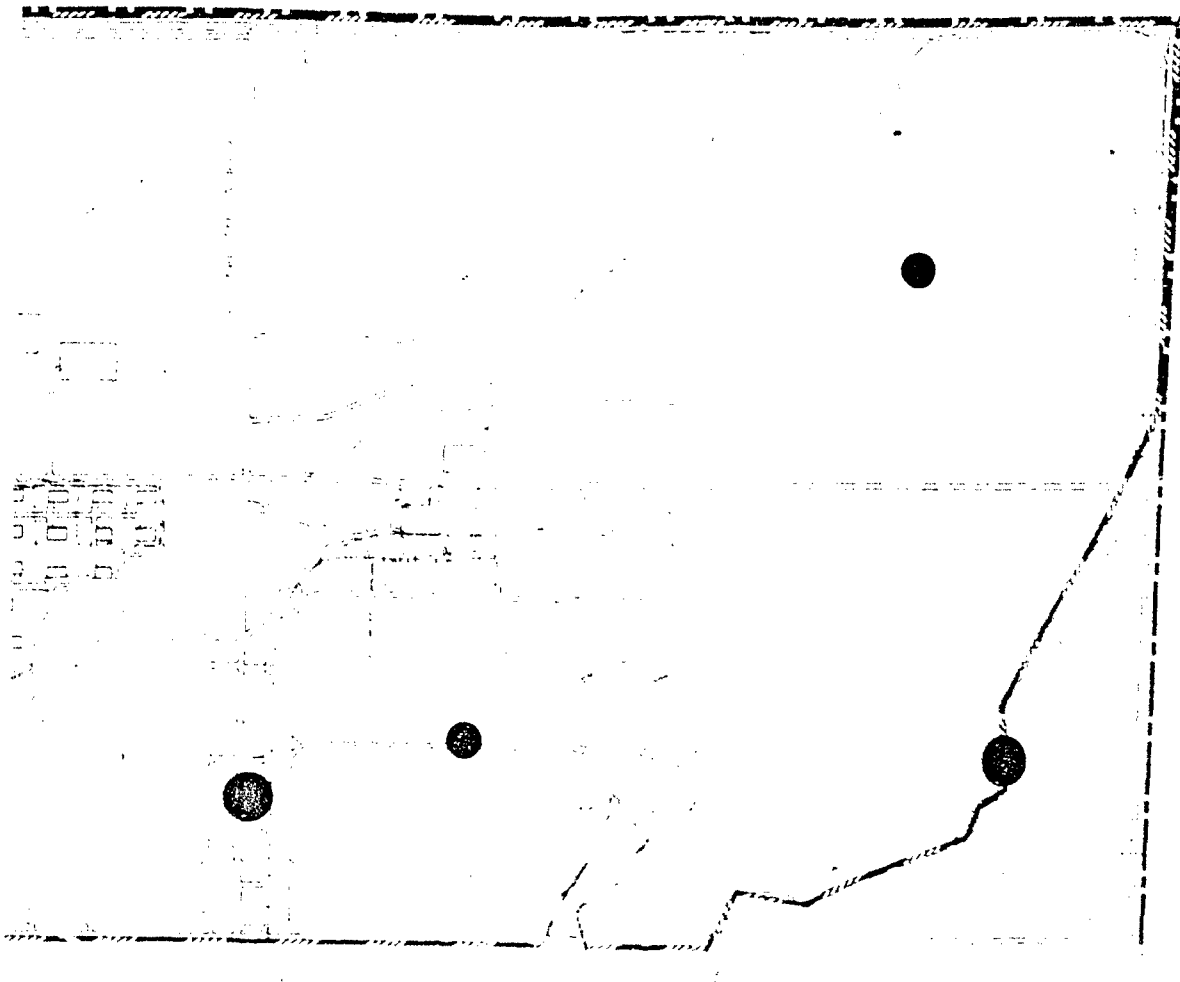
ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

○ Below Certified Reporting Limit (BCRL)

● CRL-100

● > 100

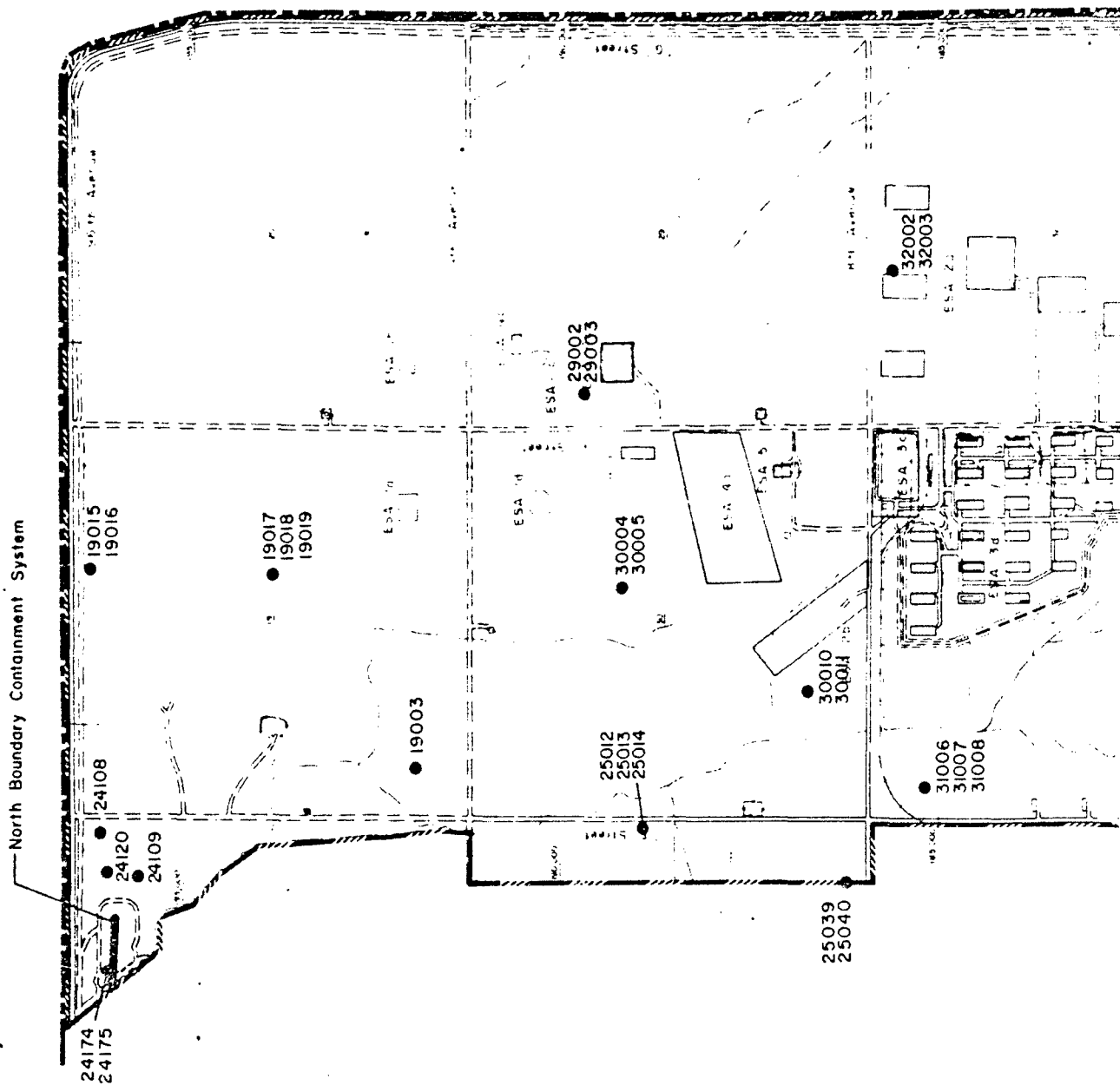


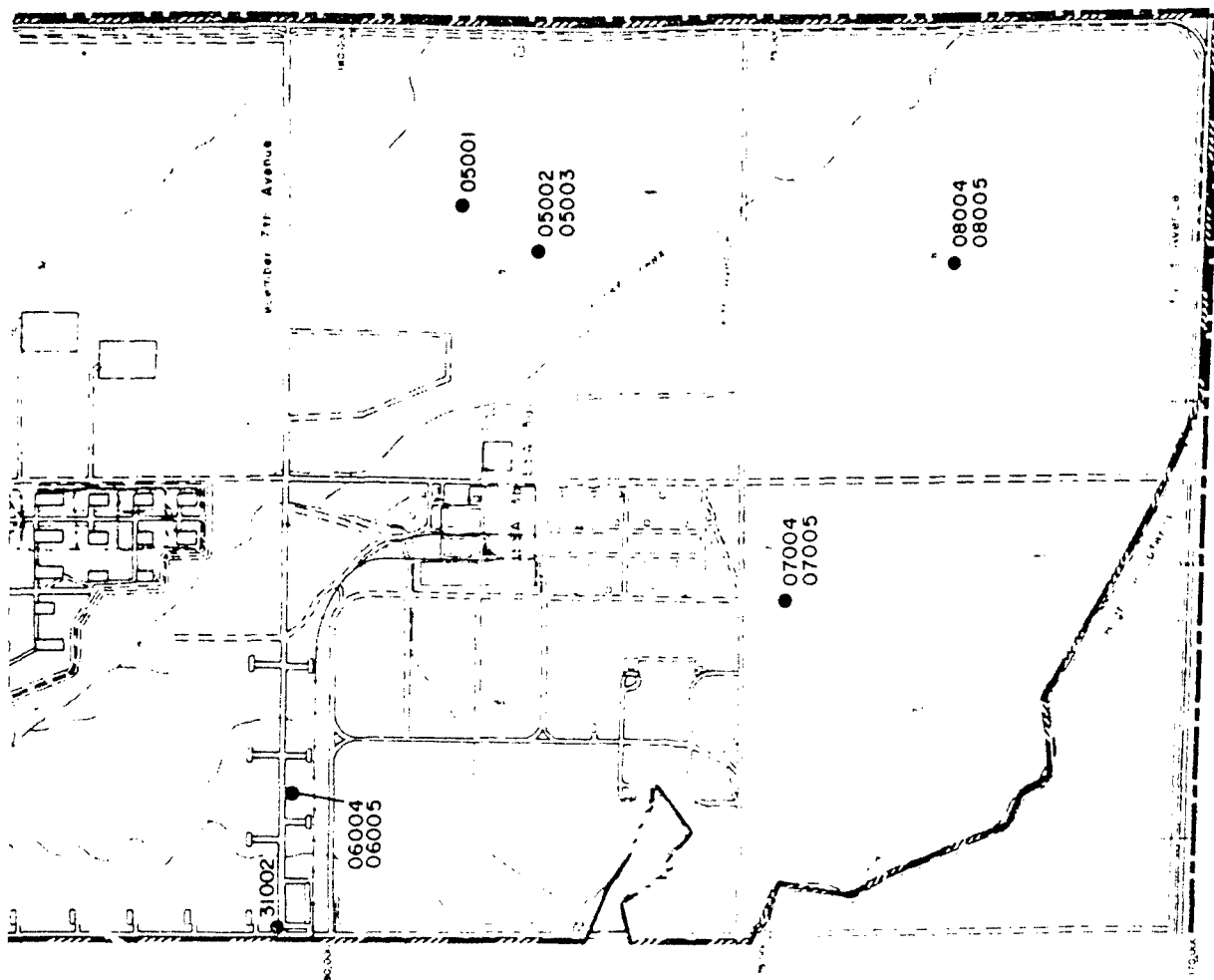


Legend

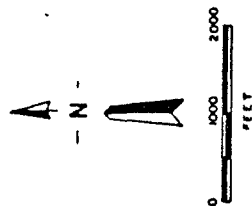
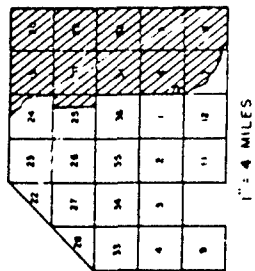
- Improved road
- Stream or ditch
- Railroad tracks
- Structure
- Eastern Study Area boundary
- State Plane Grid
- Burnt or soil mounds
- Unimproved road
- Shore line
- Section number
- Storage pads
- Artificial boundary
- Fence
- ESA-10
- Subarea boundary

19015 Denver Well Sampling Location





EASTERN STUDY AREA LOCATION AT ROCKY MOUNTAIN ARSENAL



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.3-9
Denver Well Groundwater Sampling
Locations in the Eastern Study Area

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

Legend

==	Improved road	==	Unimproved road
~	Stream or ditch	○	Shore line
---	Retired tracks	12	Section number
□	Structure	□	Storage pile
~~~~	Eastern Study Area boundary	---	Airfield boundary
10,000	State Plane grid	---	Fence
---	Berm or soil mounds	ESA-10	Subarea boundary

## ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

○ Below Certified Reporting Limit (BCRL)

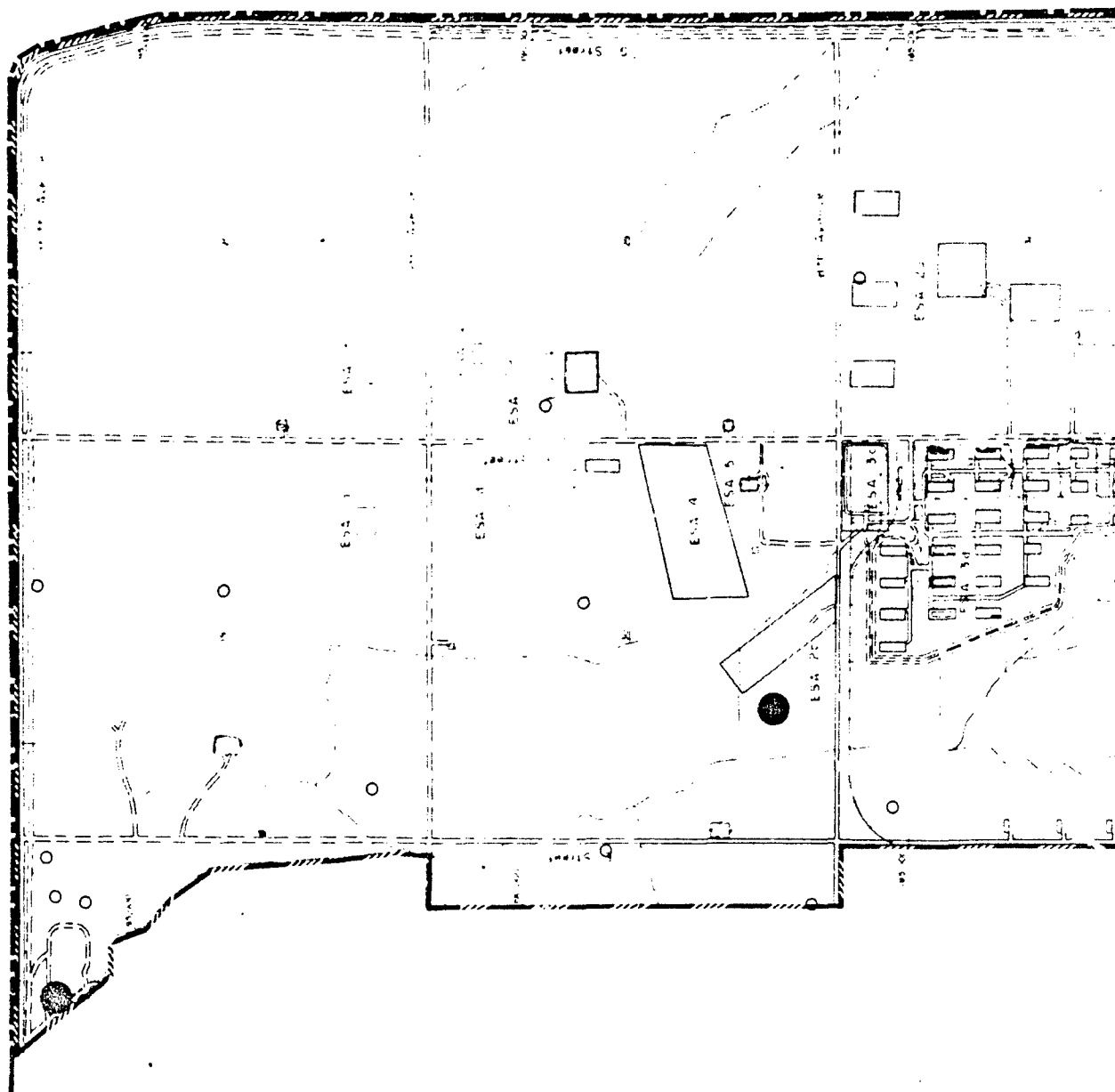
● CRL - 1.0

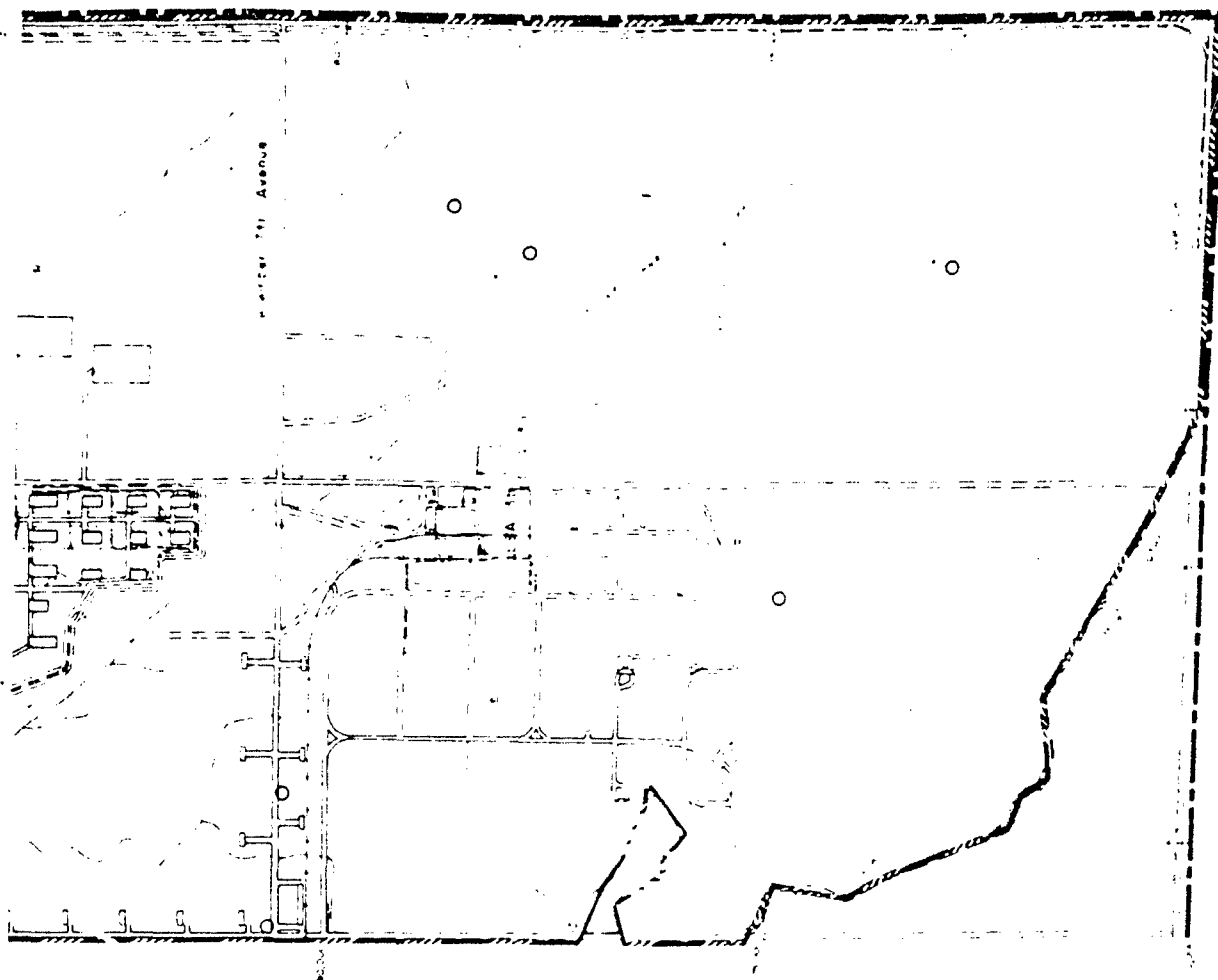
● >1.0-10

● >10-100

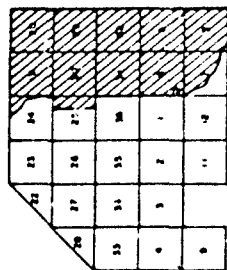
● >100

* Does not include Methylene Chloride

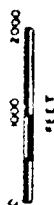
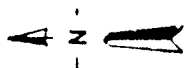




EASTERN STUDY AREA LOCATION  
AT ROCKY MOUNTAIN ARSENAL



1/4 MILES



Prepared for:

Program Manager's Office for  
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.3-10  
Volatile Halogenated Organics in  
Denver Formation Groundwater

Rocky Mountain Arsenal  
Prepared by Ebasco Services Incorporated



# Legend

Improved road	Unimproved road
Stream or ditch	Shore line
Reinforced tracks	Section number
Structure	Storage pad
Eastern Study Area boundary	Arsenal boundary
State Plane grid	Fence
Berms or soil mounds	Subarea boundary

## ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

○ Below Certified Reporting Limit (BCRL)

● CRL - 1.0

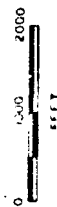
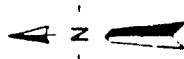
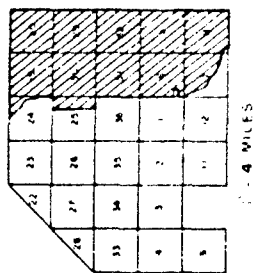
● >1.0-10

● >10-100

● >100

* A member of the VHO group, mapped separately due to its potential as a laboratory contaminant.

EASTERN STUDY AREA LOCATION  
AT ROCKY MOUNTAIN ARSENAL



Prepared for:

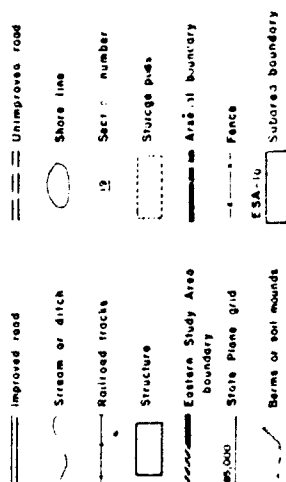
Program Manager's Office for  
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.3-11

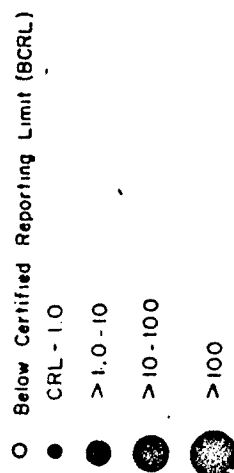
Methylene Chloride in Denver  
Formation Groundwater

Rocky Mountain Arsenal  
Prepared by Ebasco Services Incorporated

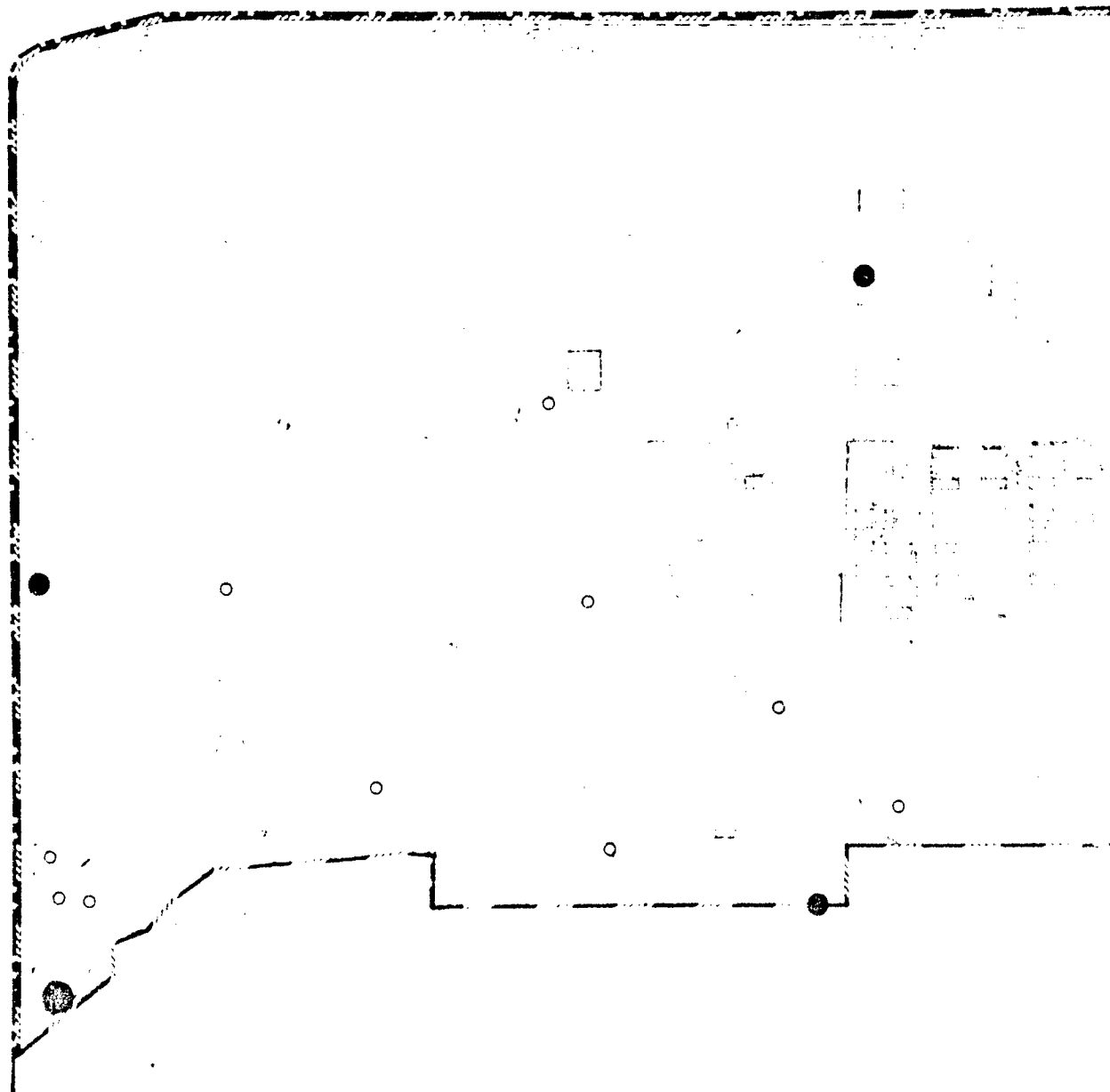
# Legend



## ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)



* All detections represent Benzene





EASTERN STUDY AREA LOCATION  
AT ROCKY MOUNTAIN ARSENAL

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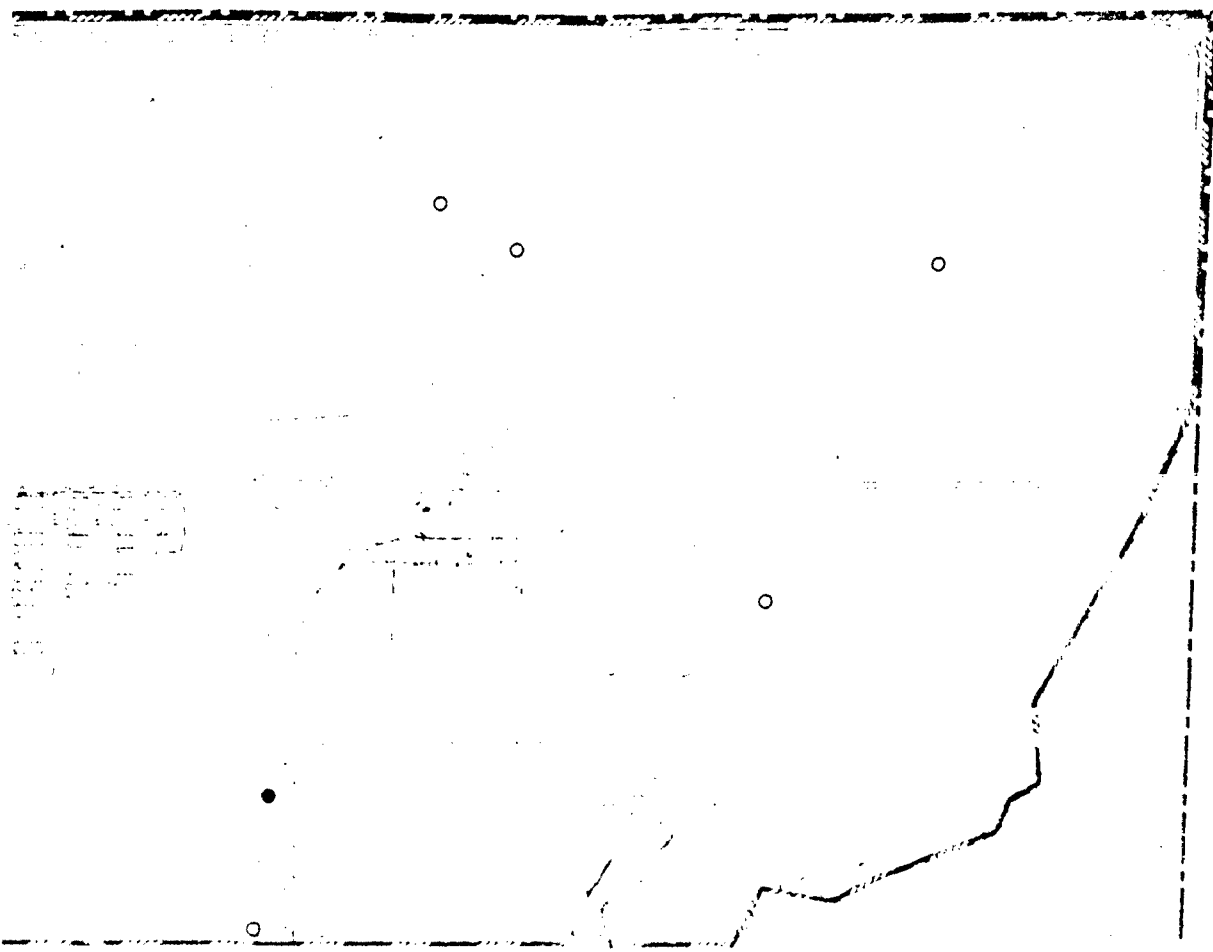
# Legend

Improved road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	Structure number
Structure	Storage pile
Eastern Shd. line	PMZ (see Arsenic boundary)
State plane grid	Fence
Berms or soil mounds	FSA-10
	Subarea boundary

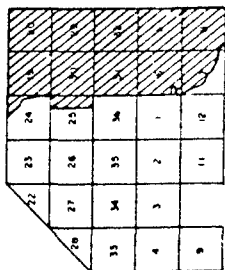
## ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

- Below Certified Reporting Limit (BCRL)
- CRL - 1.0
- > 1.0-10
- > 10-100
- > 100

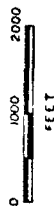
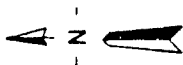




EASTERN STUDY AREA LOCATION  
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



Prepared for:

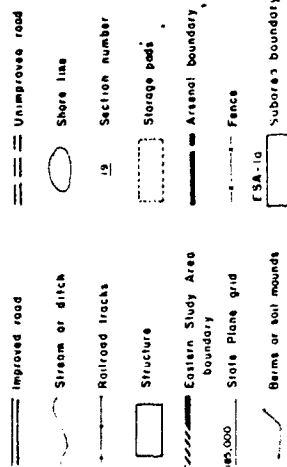
Program Manager's Office for  
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.3-13

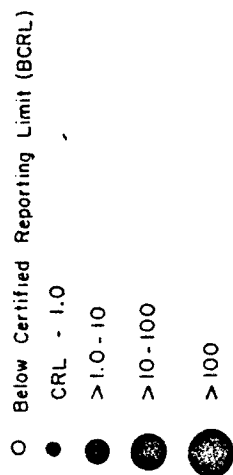
Dibromochloropropane in the  
Denver Formation Groundwater

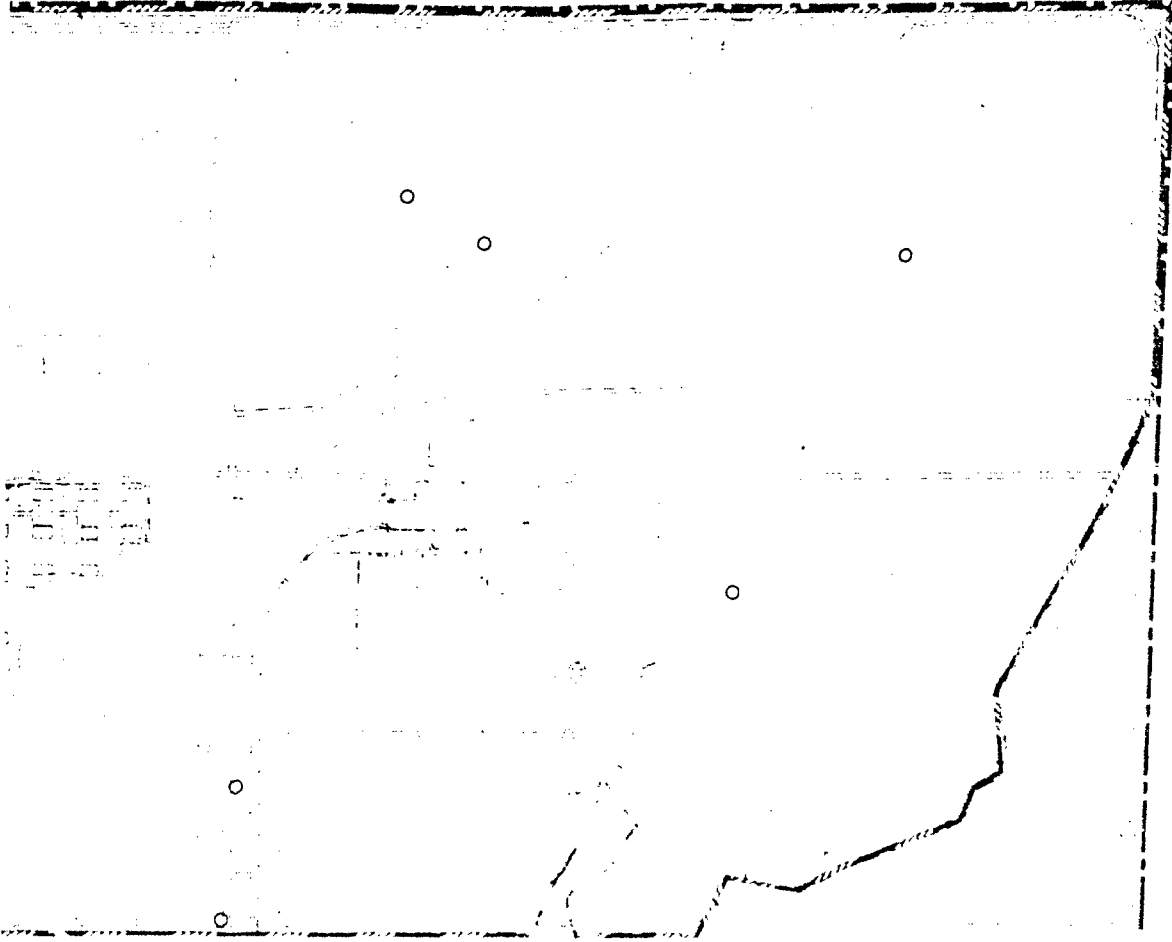
Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

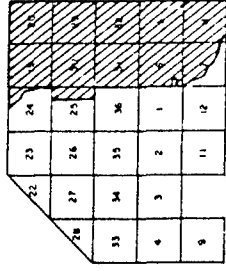


# ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

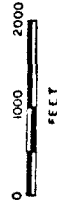
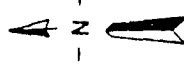




EASTERN STUDY AREA LOCATION  
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



Prepared for:

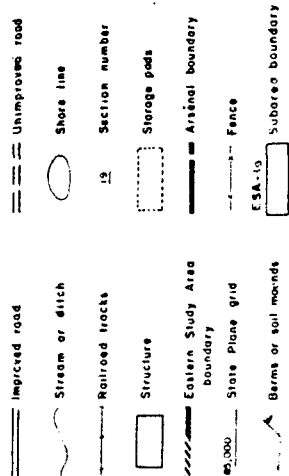
Program Manager's Office for  
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.3 -14

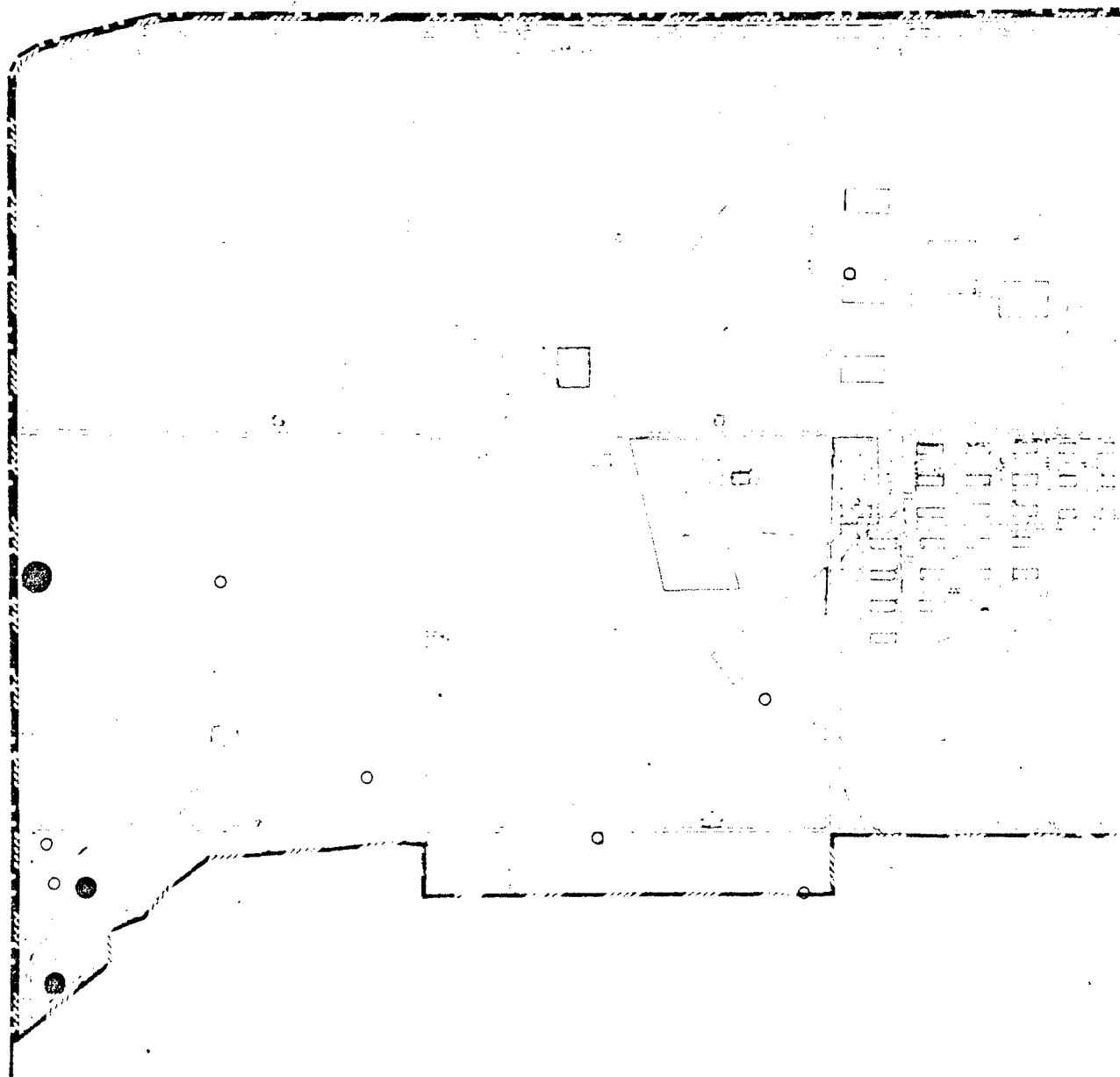
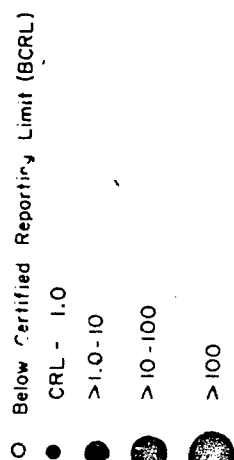
Organochlorine Pesticides in  
Denver Formation Groundwater

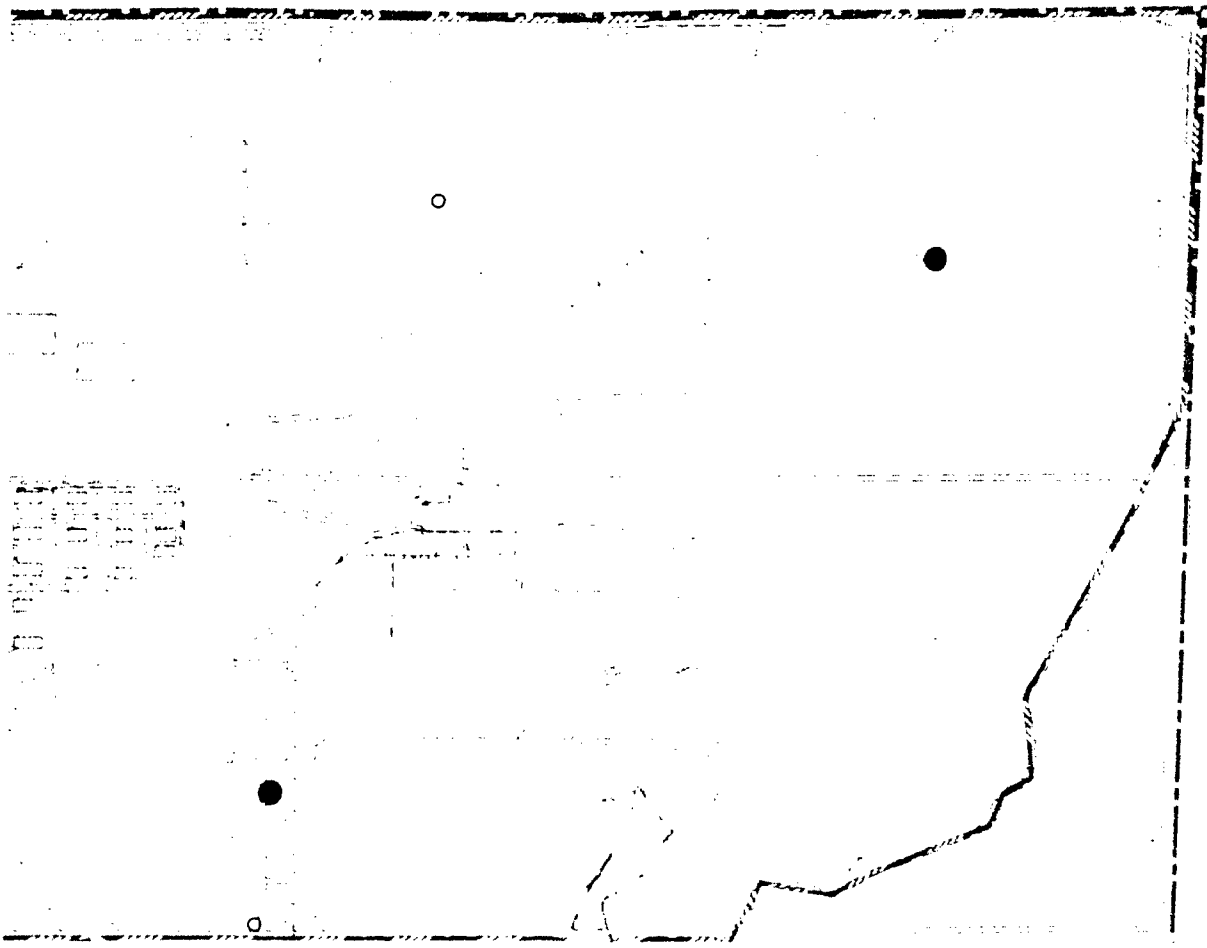
Rocky Mountain Arsenal  
Prepared by: Ebosco Services Incorporated



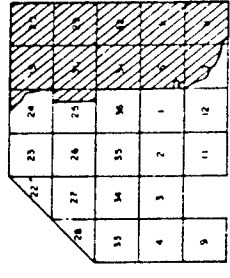


# ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

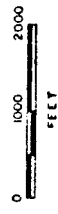
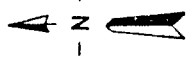




EASTERN STUDY AREA LOCATION  
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



Prepared for:

Program Manager's Office for  
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.3 - 15

Arsenic in Denver Formation  
Groundwater

Rocky Mountain Arsenal  
Prepared by: Ebasco Services Incorporated

# Legend

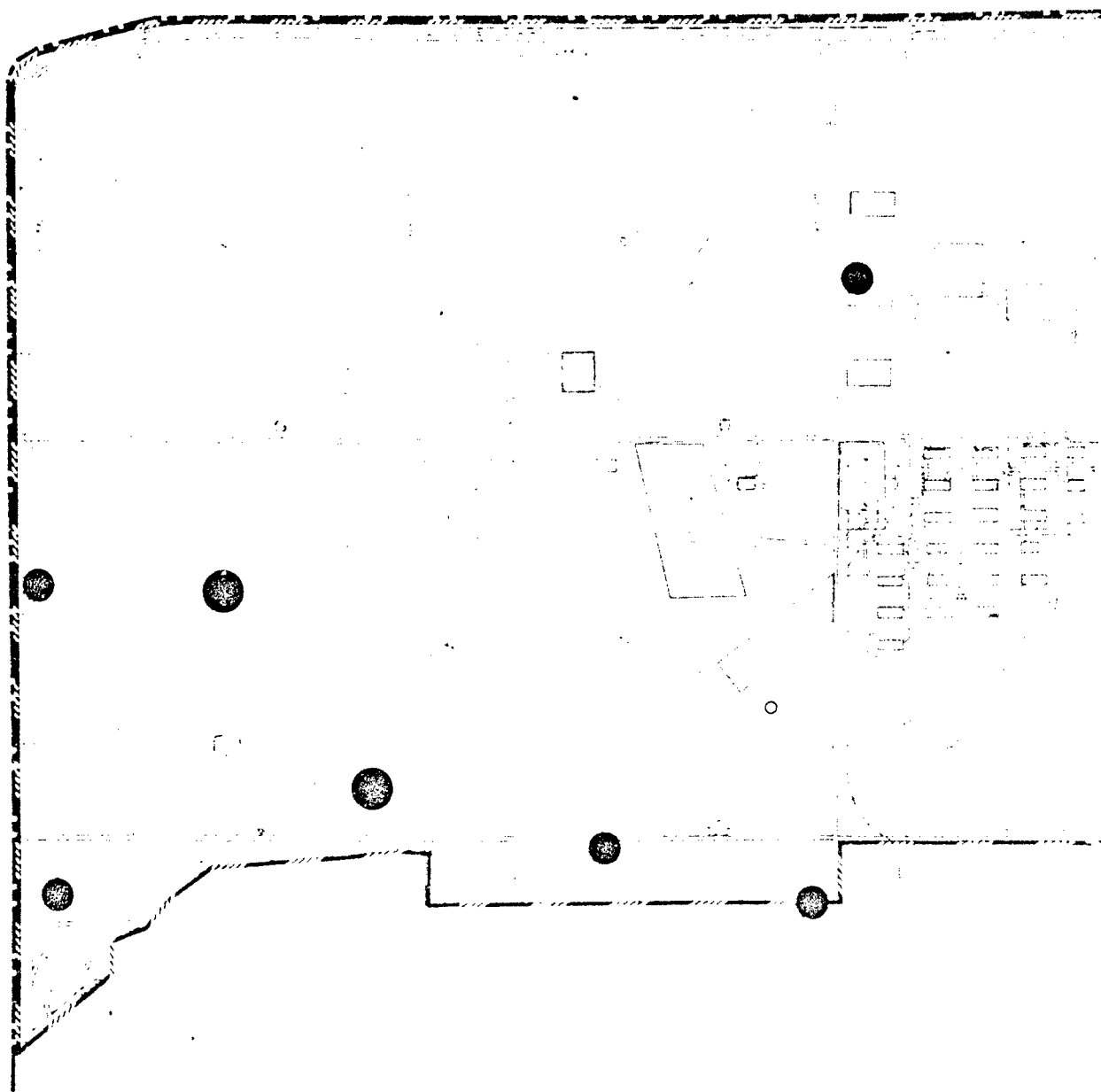
Improved road	Unimproved road
Stream or ditch	Shore line
Railroad tracks	IS Section number
Structure	Storage pits
Eastern Study Area boundary	Arsenal boundary
1:50,000 State Plane grid	Fence
Barns or soil mounds	FSA-10
	Subarea boundary

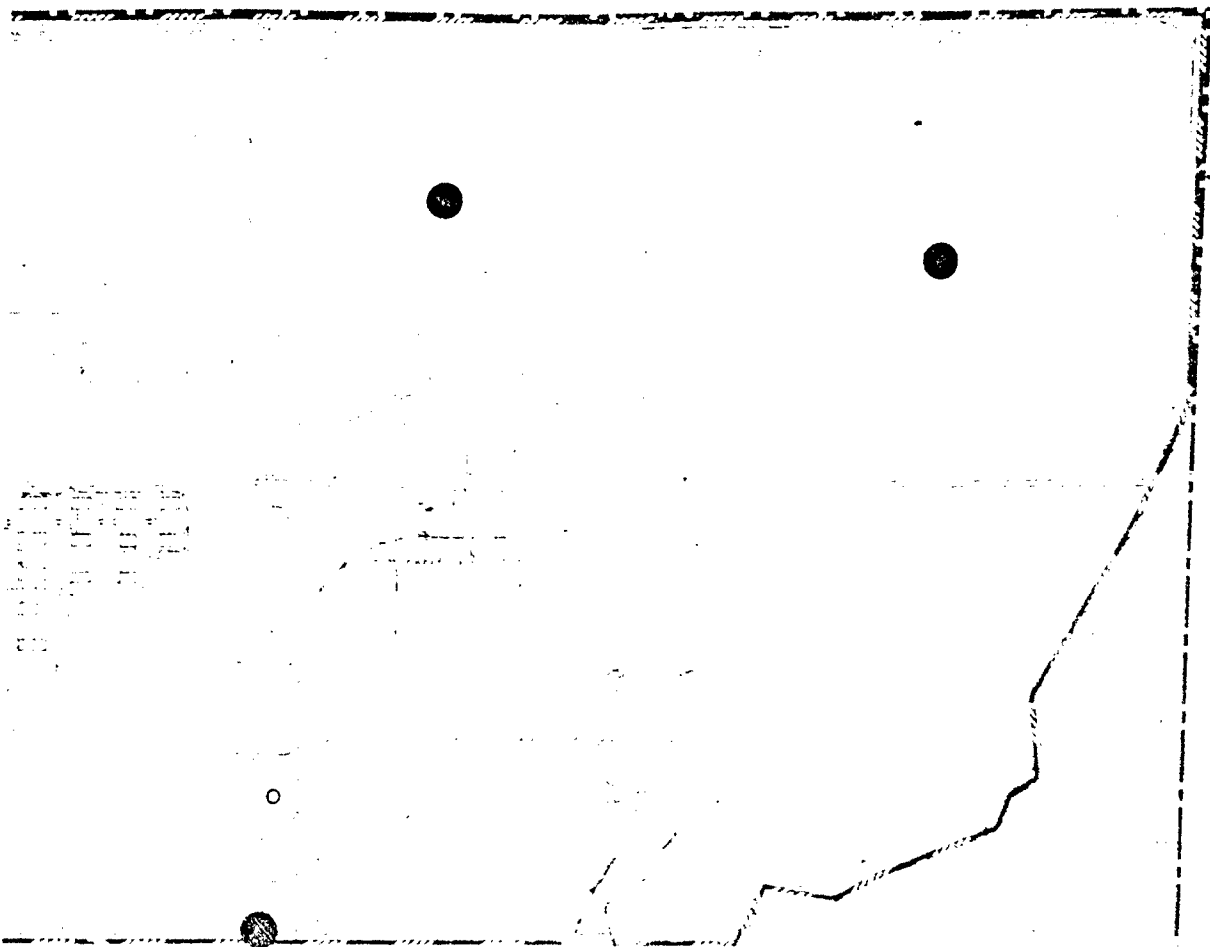
## ANALYTE SAMPLE LOCATION AND CONCENTRATION (ug/l)

○ Below Certified Reporting Limit (BCRL)

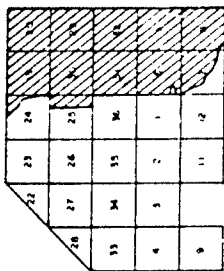
● CRL-100

● > 100

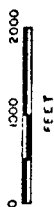
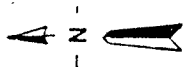




EASTERN STUDY AREA LOCATION  
AT ROCKY MOUNTAIN ARSENAL



1" = 4 MILES



Prepared for:

Program Manager's Office for  
Rocky Mountain Arsenal Cleanup

FIGURE ESA 2.3-16

ICP Metals in Denver Formation  
Groundwater

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

